An AI based mental health support chat-bot for cyber bullied victims

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Abstract— **Recent days an unprecedented increase in cyber- attacks is seen globally. There are several cyber-bullied victims that commit suicide every year consequence of their sensitive information being publicized. The victims who are being bullied or blackmailed need mental support and guidance on how to react. And some of the victims due to defamation may go as far as taking their lives. So we've built an AI chat-bot specifically for cyber bully victims as they may not directly plea for human help. Conversing with bots might seem secure and reassuring than to have a conversation with humans as bots maintain secrecy. The bot comprehends user's query and responds accordingly using Natural language Processing (NLP) and Natural language understanding (NLU), which mainly includes three features such as providing guidance on how to approach concerned authorities, providing information regarding cyber bullying as well as mental health and also assisting their mental health. We integrated our chatbot into a website which is created using html, css and javascript and then deployed it locally.**

Keywords—**Cyber-Crime, Victim Mental Health Support, Chat Bot, Natural Language Understanding, Natural Language Processing, Botpress, Brainshop.AI,**

1. INTRODUCTION

Chatbots are actually computer programmes that mimic human conversation in order to improve user experience. Many websites create their own chatbots to help their customers or users. Such integrated chatbots deal with answering user queries about respective websites or a particular product. The aim of our project is to help victims to raise complaints against several cyber crimes. With the help of our integrated chatbots user queries related to cyber crimes as well as mental health will be answered. This also helps in providing awareness to people on how to be safe online. And for the people who are on a verge to commit suicide, Our integrated friendly chat bot will be an effective way to lead them into a good conversation which eventually will make them feel better.

NLP belongs to the category of artificial intelligence. It handles enormous volumes of data related to human language. It includes the entire system, from interpreting data to making choices while interacting.such as to read information, analyse it, comprehend it, and come to conclusions about how to respond. While NLU is a subset of NLP and it is utilized to analyse data so that users can understand its significance and properly process it. By understanding the text's origins, meaning, syntax, intention, and sentiment, it finds a solution.

Botpress is a modern developer environment for creating, running, and enhancing conversational AI applications. It is an open-source platform that allows programmers to create top-notch digital assistants. It allows us to control the flow of conversations. Similarly BrainShop is also an artificial intelligence-capable chatbot service provider with configurable features. It is capable of generating responses based on created and trained brains.

The number of cyber bully victims in India is increasing day to day and few of them are going as far as taking their own lives. The amount of grief caused by defamation, uncertainty, and shock they face is hard to endure. By listing down the root causes for the whole situation, we understood that there is a lack of awareness among people. Also there are insufficient sources to guide and support victims. Many people have less idea about how to deal if they find themselves in such situations. So our project aims to help such victims through our guidance as well as our friendly

bots. Guidance bot clarifies all queries of victims related to cyber bullying as well as mental health related queries. It also provides guidance for parents on how to react if they find their child to be a possible victim or a bully. Our friendly bot on the other hand will converse with victims to make them feel better. Also as bot's maintain secrecy it'll be easy for victims to open up and share their concerns. So if someone is struggling with anxiety or depression, a mental health chatbot could be worth considering. Our motivation to support them in their struggle comes from this very fact.

Nowadays we see an unprecedented growth in cyber bullying related cases. Having mental health related issues is a big problem that many of us don't want to address. Also no one even wants to talk about it. India is on the verge of a mental health epidemic, yet only few people are working hard to find a way to prevent it or treat it. So there is a need to address such issues. We need mental health support chatbots for cyber bullied victims which can help in guiding them and also help them get out of their trauma. Chatbots are often proven effective to provide a person with assistance and offer some sort of companionship. These bots can never replace therapy or therapists because one can never replace human connection, but as millions of people worldwide will never visit a therapist, despite the fact that doing so would be extremely beneficial to them, We require these kinds of chatbots which can provide some sort of assistance and guidance to bullied victims.

Since our website is interactive, individuals can easily understand and use it, also guidance bot provides awareness to the users on how to be safe online. As it is said that prevention is better than cure, it's important to educate people and create awareness before they face any such situations in real time. Conversing with a chatbot will be useful for such depressed and stressed-out victims.

The order and structure of our paper are as follows: Literature reviews of several connected works are shown in Section 2. The architecture, approach, and algorithms are described in the following part, Section 3. And lastly, Section 4 includes result analysis, conclusion, and recommendations for further study.

2. RELATED WORKS

In 2021, E. Kasthuri et al. proposed [1] created a chatbot by using machine learning and deep learning technologies with an LSTM algorithm based on RNN,for helping students with instant replies without human interference by voice or textual content which solves mathematical queries.

In 2020,D.Biswas et al. in [2] gives two techniques for chatbot dialogues that preserve user privacy,which are Entity-based privacy filtering,and the second approach is for consumers' conversation privacy to be protected using searchable encryption.

In 2022,de Andrade et al. published journal [3] which proposed CMP(chatbot management process) is a mechanism for post-deployment administration of machine learning

chatbots. By permitting a cyclical and human- supervised process, this methodology's main goal is to analyse user interactions in order to evolve the chatbot's content.

In 2021, A. Miklosik et.al [4] aimed to undertake a systematic review of relevant research articles from high-quality journals to just summarise the existing level of knowledge about chatbots, pinpoint their function in the transformation of digital businesses, and highlight the areas needing more study.

In 2022, Ren et.al in journal [5] carried out a comprehensive mapping analysis to identify the characteristics, criteria for evaluating the use of chatbots and also examine user satisfaction utilise chatbots to learn and achieve their goals which results real-time responses and improved usability.

In 2022,S.Chakraborty et.al [6] meant to spread awareness on medical treatment to fight against illness.They suggested a deep feedforward multilayer perceptron-based model for AI Chatbot interaction and prediction as well as "TensorFlow," which uses deep neural network architecture to perform natural language processing for chatbots.

In 2021,K. Denecke et.al [7] designed SERMO, a cellular app which includes a virtual assistant that applies CBT techniques to assist students with mental illness in managing their experiences and views.It uses a dialog based user interface which is implemented by nlp and sentiment analysis.

In 2017, Cameron et.al [8] recommend a chatbot's layout use in mental health counselling.users view chatbots to be comfortable and safe to converse with and who prefer not to receive face-to-face therapy have an alternative like chatbots.A well-known natural language understanding platform API.ai.This will be used to facilitate further user interaction with the chatbot.

In 2019,Abd-alrazaq et.al [9] claims that chatbots may be beneficial for those with mental problems,to counsel out of stigma..The purposes, sites, targeted discourse, input and output modes, response production, embodiment, illnesses were used to categorise chatbots in this study.

In 2019,el Hajal et.al [10] focusses on strengthening security by increasing user cyber awareness and building a human firewall.A conversational bot powered by AI that serves as a personal assistant for security-related concerns and focuses on cyber threat awareness has been developed.This bot, uses an AI-based approach, uses WhatsApp as a communication tool to make user interactions more enticing and conversational.

In 2019,Michelle C. et.al [11] sought to examine the Turing Test's phases, how they relate to factual and hypothetical issues, as well as how recent uses of artificial intelligence are employed mental wellbeing therapies.AI has the potential to be advantageous to society, as evidenced by developments in mental health therapy.

Fitzpatrick et.al [12] conducted a study to find out whether automated conversational agent could be useful in delivering

a self-help session to university graduates who self-report displaying signs of anxiety and sadness."Woebot" is an artificially intelligent conversational agent created to give CBT through brief, daily interactions and mood monitoring.

Vandebosch et.al [13] to broaden the focus of earlier evaluations of peer aggression by looking at new research, regarding the part of technology pertaining to the avoidance, detection, and management of peer violence among teenagers.Machine learning algorithms are created to deal with peer aggression both online and off.

Nataliya B et.al [14] intended to examine the components of the rapidly expanding Cyber World.The study primarily focuses on the options for safeguarding the cyberworld from us and for defending ourselves against cybercrime.As a result, it highlights the value of policy design and implementation, awareness raising, and user education beginning at a young age.

In 2022,Theodora Koulouri et.al [15] presented three research efforts, the first is a survey of individuals about their mental health and examines if Particularly chatbots, may be a viable option for young people seeking treatment for their mental illness. Second, a literature review synthesises regarding mental health conversational agents and third is interviews with counsellors which is supported by a chatbot prototype from a mental health specialists' point of view.

Ellis et.al [16] proposed a subjective smart investigation that used the social media network Instagram to investigate how American adult university students experienced cyberbullying. This study found that social networking users might be coerced into engaging in some form of cyberbullying via bots.

3. PROPOSED METHOD

The proposed methodology of this paper consists of architecture of the proposed system, methodology and Implementation.

3.1. ARCHITECTURE:

From the below shown architecture diagram in Fig 1, we can observe that the front-end client first selects one of our guidance or friendly bot through a browser page that we have designed and it can be seen in Fig 2. The functionality of the chatbot depends on which chatbot the user has selected. Both of these chatbots take queries from the front- end client. If it's a guidance bot , input processing takes place. The emulator then consults the botpress engine to identify the intent to which the query belongs, recognises and classifies the intent using information from the botpress database, and consults the conversation manager to determine the flow or subflow in which the query travels before responding to the emulator. After then, the user receives the response.If it is a Friendly bot it will understand the query, handle the dialogue manager, track the question, and generate an answer from the database.Brainshop.ai generates the user's response using natural language generation and response is given to the user.

We have also integrated whatsapp redirect in our website so that people who wish to converse with doctors or specialists can use it. It directly redirects users into an expert's chat window on clicking.
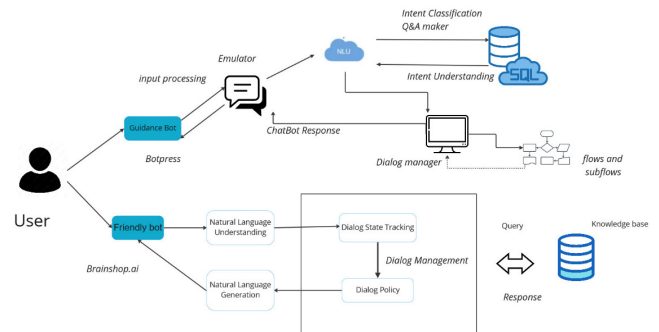

Fig 1: The Proposed System Architecture

3.2. METHODOLOGY:

Both of our bots are trained using NLU, NLG as well as NLP algorithms. The two key elements of NLP are NLU and NLG.

Machine comprehension is the main focus of NLU. Whereas reading, understanding, and making machines understand human language is the ultimate goal of NLP. They use few algorithms to convert human speech into structured ontology. They recognize things like semantics, timing, locations, and intent. Firstly data is processed and a few steps like Tokenization, lemmatization, parsing, information extraction, similarity, speech recognition, are done in this pre-processing.

3.2.1. Data Processing techniques:

There are a set of procedures used to process raw text data in order to get it ready for additional analysis. Text pre-processing is transforming the unstructured text material into a structured form that NLP systems can quickly handle and evaluate. The standardisation of the text, reduction of dimensionality, bag of words, and stop words removal procedures are used to enhance the performance of NLP algorithms. Majority of the steps involved will be implicitly done by NLU engine of botpress as well as by the brainshop.ai which makes them developer friendly. The benefit of using these platforms is that developers don't have to explicitly handle these events.

Text normalisation: Text normalisation refers to the process of standardising text. This could entail making text lowercase, deleting punctuation, and standardising the format of dates and numerals.

Tokenization: It is the act of dividing a lengthy text into manageable units, or tokens, which can be words, phrases, or even complete sentences. Tokenization transforms unstructured text into a structured form that NLP computers can handle and analyse with ease.

Stop Word Removal: To decrease the dimensionality of text data and boost the effectiveness of NLP algorithms, stop words—common words with little meaning—are frequently eliminated. Stop words include "the," "and," "a," "an," and others. Because removing stop words minimises the number of irrelevant words that the algorithm must process, it can increase the precision of several NLP algorithms, including text categorization and information retrieval.

*Lemmatization***:** The method of compressing words to lemma, which is the dictionary form of a word, is known as lemmatization. This procedure reduces the number of dimensions in the data and standardizes the words in a text. For instance, the lemma "run" can be formed from the words "running," "ran," and "run."

*Stemming***:** Similar to lemmatization, stemming is the process of breaking down words into their most basic forms. Lemmatization produces standard words, whereas stemming is a more aggressive procedure that frequently produces non-standard terms.

Part-of-Speech Tagging: The practice of naming every term in a document by its appropriate part of speech, such as a noun, verb, adjective, etc., is known as part-of- speech tagging. Many NLP systems use this data to determine the context and meaning of words.

*Named Entity Recognition***:** Identification of named entities, such as individuals, organisations, places, etc., in a text is referred to as named entity recognition. Numerous NLP applications, including data extraction and question-answering, can benefit from this information.

*Removing Duplicate and Irrelevant Data***:** Getting Rid of Duplicate and Irrelevant Information is the process of getting rid of unnecessary and redundant information from text data. This can entail eliminating duplicate documents, pointless terms, and often used words that don't add to the text's meaning.

3.2.2. Conversational techniques:

Processed text messages are then subjected to operations such such as pattern extraction, entity separation, and intent categorization.

Intent Classification: It is utilized to establish the goal or function of the input information such as consumer content rather than employing keywords, to try to understand the user's purpose.

Entity Extraction: This message analysis technique extracts particular information from the source and groups it all into predetermined groups.

*Pattern extraction***:** NLU will add every input phrase to the relevant area in event.nlu.entities in Botpress tool. after comparing it to a regex.

The second module of our project, i.e comes under the Self-Learning, Rule-Based category of AI chatbots. Whereas the Third module i.e Friendly bot comes under Self-Learning,

Generative category of AI chatbots Features such as language understanding, entity recognition, and intent classification are provided by a variety of NLP algorithms.

But the specific NLP library or model that is integrated with it always determines the algorithms that are employed. For example, Botpress supports integration with popular NLP libraries such as spaCy, Rasa NLU, and Snips NLU, each of which uses its own NLP algorithms.

3.2.3. NLP libraries.

*spaCy NLU***:** spaCy is an open-source NLP library in Python that provides advanced NLP capabilities, including named entity identification, dependency parsing, part-of- speech tagging, tokenization, and more. It is designed for performance, with a highly optimized Cython-based implementation and multi-threading, and is known for its high accuracy and consistency across different languages. spaCy has a modular architecture that allows users to add or replace specific components, and provides pre-trained models for several languages.

*Rasa NLU***:** It is a freely accessible NLP library that provides algorithms for intent classification and entity recognition. It uses techniques for machine learning, comprising decision trees and support vector machines , to perform these tasks. Rasa NLU is designed to be flexible and allows for custom integrations with other NLP libraries or models.

*Snips NLU***:** Snips NLU is an open-source NLP library that provides algorithms for intent classification, slot filling, and entity recognition. It uses a deep learning-based approach to perform these tasks and is designed to be fast and efficient. Snips NLU provides pre-trained models for several languages and allows for customization through its API.

3.2.4. Algorithms:

NLP Algorithms like Cosine similarity are used for edit distance. It includes other Algorithms like Vectorization, Bag of words, TF-IDF algorithm, Text normalization, Naive Bayes algorithm, Word embedding LSTM etc.

*TF-IDF***:** It is an analytical algorithm that is often used in NLP for feature extraction and text classification. It measures by examining the intensity of words both within the phase and throughout a group of documents, one can determine a word's significance.TF-IDF is a simple and widely used algorithm that is often used as a baseline for NLP tasks.

*Naive Bayes***:** It is a simple machine learning. It is frequently applied in NLP to text categorization jobs. Its foundation is the Bayes theorem and assumes independence between features, which is why it is called "naive". Naive Bayes is fast and easy to implement, making it a popular choice for NLP tasks with limited data.

LSTM: It is a kind of recurrent neural network that is widely used in NLP with activities including text synthesis, machine translation, and language modelling. LSTMs are particularly well-suited for NLP responsibilities that call for modelling

lengthy dependencies between inputs. They are computationally expensive, but give reduced outcomes for many NLP tasks.

3.3. IMPLEMENTATION

There are four modules present in our methodology which are raising complaints, getting information from guidance chatbot, conversing with friendly chatbot, consulting specialists through WhatsApp.

3.3.1. Raising complaints:

After opening the website as depicted in Fig 2, users can click on the 'helpline' button which redirects them to all the emergency helpline numbers available. Users can make use of those numbers to contact higher authorities and raise a complaint against cyber criminals. If not, they can click on the 'lodge complaint' button to redirect themselves to the national cybercrime reporting portal.
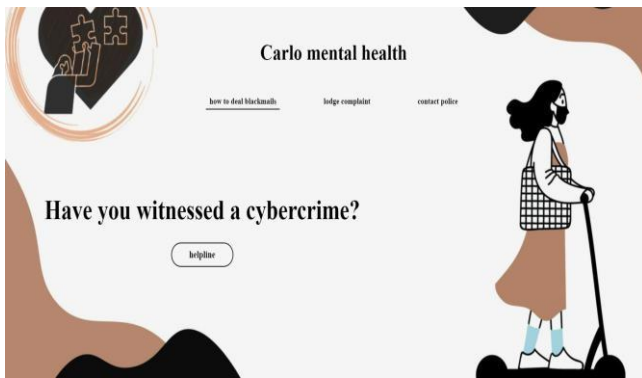
Fig 2: webpage with helpline and lodge complaint buttons

3.3.2. Guidance Bot :

If it's our guidance bot then the request is forwarded to the Botpress Engine, which aids in intent classification and entity extraction. It further aids in generating slots based on user requests. Firstly, we designed the conversational flow in the workflow section so that we can see the actual flow of the conversation. We created multiple intents and allocated each intent with a large set of related possible user queries. The model is then trained so that the machine can now identify which type of questions belong to which intent. Whenever a query is asked, user intent is identified by the trained model. On identifying user intent, intent understanding and slot tagging functionalities will be performed. And the control will return back to the botpress engine. From then the dialog manager will handle the flow of the conversation. The answer corresponding to the user intent will be displayed in the chat emulator. Right from the opening message to the very last message the entire chat flow is designed using workflow in the botpress. Entire conversation flow of this guidance bot can be seen in Fig 4. Also the below Fig 3 depicts the web page containing our guidance chatbot.
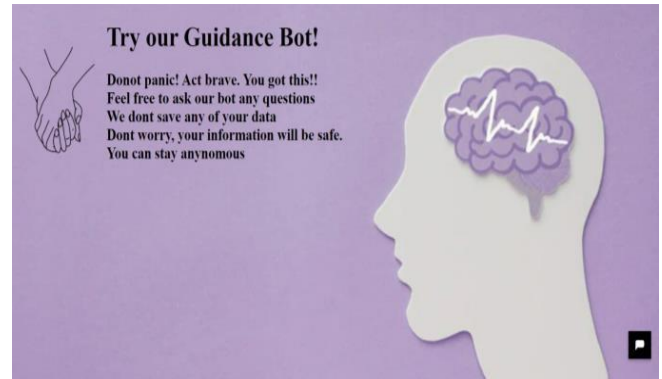

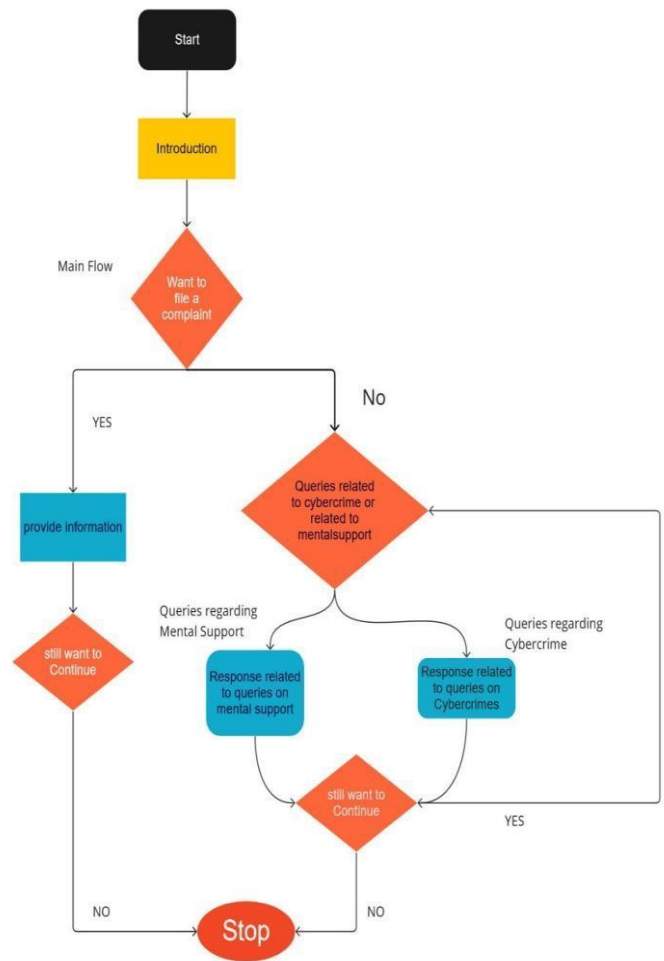Fig 3: Interface Preview with our integrated guidance bot.

Fig 4: Conversation flow of Guidance Chatbot

3.3.3. Friendly Bot :

Let's say the user has selected our friendly bot then the user message will be handled using BrainShop REST API. It consists of modules such as NLP, NLU, NLG. At first we created brains which consist of cells and those cells determine the brain's response to specific behavior of end users. Those trained brain's will give responses back to the user. The webpage in which our friendly bot has integrated can be seen in Fig 5.
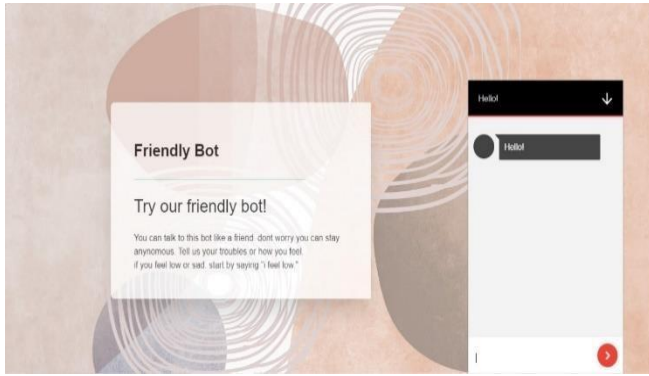
Fig 5: Interface Preview with our integrated friendly bot.

3.3.4. WhatsApp redirect and hosting the website:

A Whatsapp icon button as shown in Fig 6 is used in our web page,on clicking which redirects users into a therapist or an expert's chat window in whatsapp application. Then we created a public repository named "icarlo.github.io" in GitHub and then cloned the repository through terminal. Later pushed and committed our local files into it. Finally we activated the site. In this way we hosted our website and it can be seen in Fig 7.
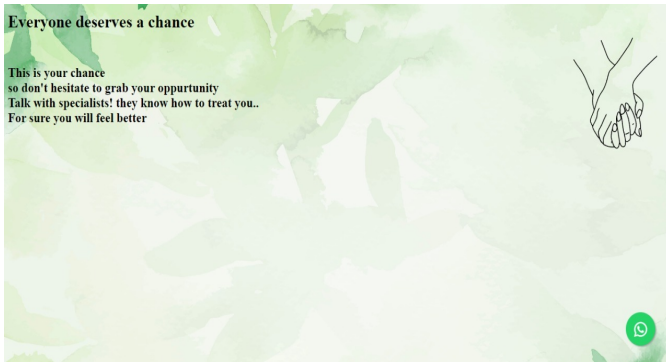
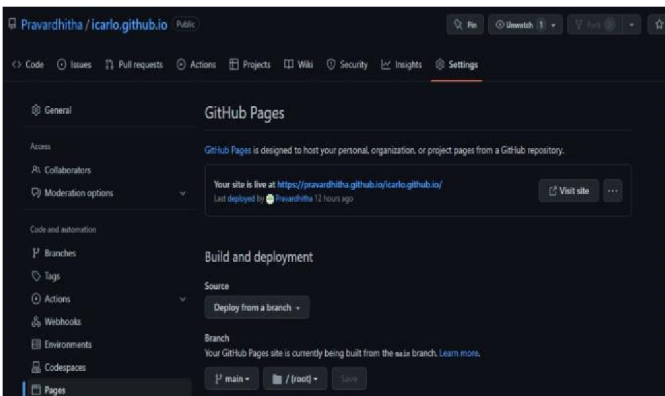Fig 6: Web Page consisting of WhatsApp icon button.

Fig 7: Website hosting with the help of GitHub

4. RESULTS AND ANALYSIS

The lodge complaint and helpline buttons as shown in Fig 2 successfully redirect users to the National cybercrime reporting portal and a website containing all emergency numbers.

The Guidance bot is successfully trained and tested. The web application has been developed and is producing the outputs as required. The user is presented with the necessary alternatives by the Botpress Workflow module, which then accepts the chosen option and presents more options in accordance with the flow. The NLU unit takes entered user queries, looks up developer-provided intents, and does other tasks as needed. and gives us the response. Everything by the bot is executed according to the conversational flow that is created hence the WorkFlow module gives approximately 100 percent accuracy. Failed instances which occur occasionally are used to train the bot again so that the machine learns what exactly is the desired response of the user. This helps in achieving more accuracy.

For this specific module, the accuracy is around 100 percent which can be seen in Figure. The bot's NLU module's accuracy is based on the intended uses for which it has been taught and the training statements for all of those uses. When the variety of the statements used to train the bot rises, the NLU module's precision level rises. Conversation flow and range of replies provided by the chatbot in response to different user inputs are shown in the following graphs. The Guidance chatbot discussed in this article responds within 4 to 7 seconds when a user precisely chooses one of the alternatives in its flow as the request for a message. In contrast, when the NLU module is employed and the user enters in the query, it takes around five to seven seconds to get a suitable result. Fig 8 shows a typical conversation with our guidance bot and its result accuracy can be seen in Fig 9.
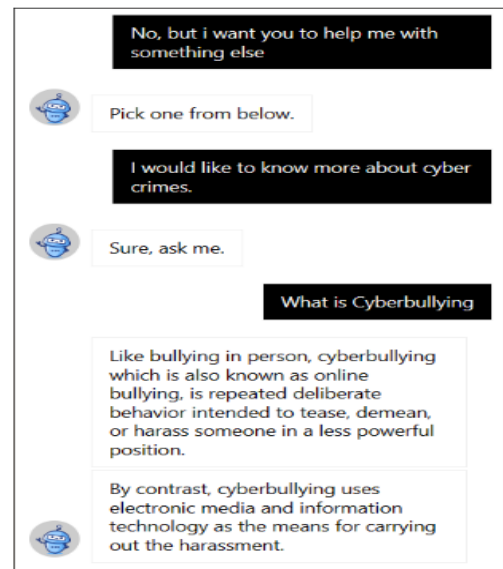

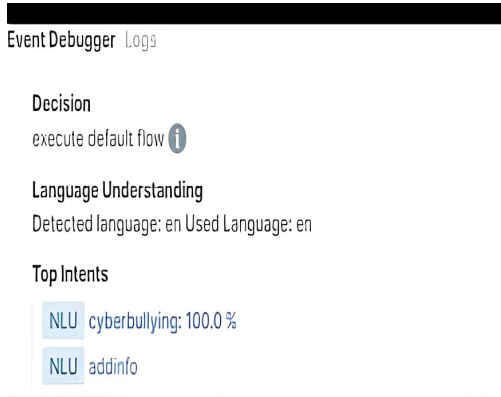Fig 8: Sample conversation-1 with the Guidance bot.

Fig 9: Accuracy of sample conversation-1

Another sample conversation with Guidance bot can be seen in Fig 10 and its corresponding result accuracy can be seen in Fig 11. Figures 9 and 11 demonstrate two examples of guidance bot accurately identifying the user's intents in response to a specific inquiry.
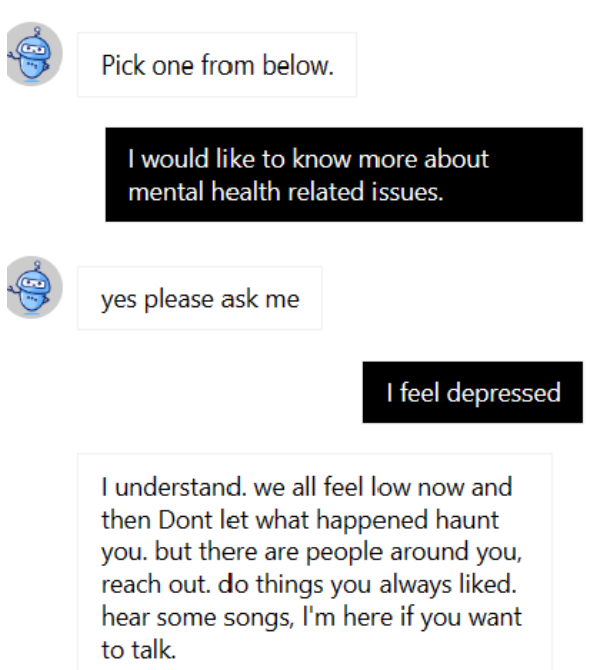

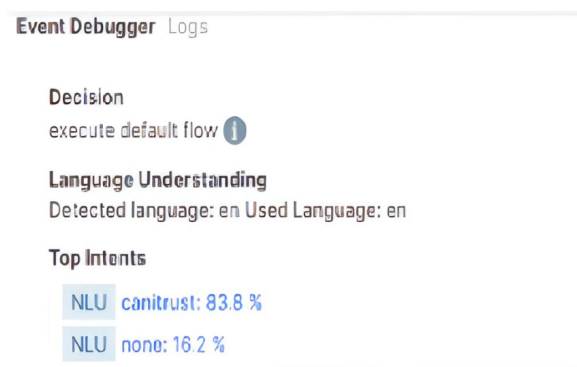Fig 10: Sample conversation-2 with the Guidance bot.

Fig 11: Accuracy of sample conversation-2

The figures mentioned earlier show that the chatbot will respond appropriately if the user's enquiry falls within its purview. If not, the chatbot apologizes and respectfully asks the user to give it another shot.
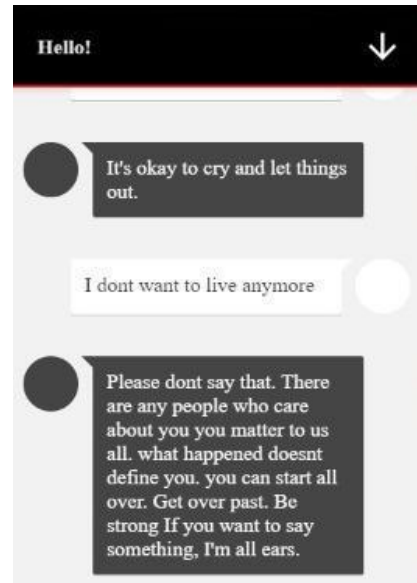

Fig 12: Sample conversation with friendly bot

The above shown friendly bot converses with the user which is developed by using Brainshop API. It can be trained by using NLP algorithms and can give us appropriate responses. The accuracy of our chatbot was tested, and the results showed an average accuracy score of 94.75% for the guidance bot.

5. CONCLUSION AND FUTURE WORK

We designed a website which is created mainly to support cyberbullied victims. It allows users to raise complaints by providing emergency helpline numbers or by successfully redirecting them to the national cybercrime reporting portal. It consists of two chatbots. Guidance Chatbot addresses queries regarding cyber crimes and mental health relevant Inquiries. This bot has shown to be quite beneficial for cybercrime victims that need guidance to complain and provide mental support assistance to those who suffer inferior to complain and may simply obtain the information by conversing with the bot. Similarly our Friendly virtual assistant has proven to be effective as it converse with the user in a friendly and effective manner. Our WhatsApp redirect function which is embedded in our website accurately connects psychologists to our clients.

The main recommendation we received from those who reviewed our chatbot is to broaden its use, i.e., expand the range of questions about cybercrimes that may be answered. For now, as we confined ourselves to only cyber bullying, In the future we would intend to expand the chatbot's capabilities, in other words, increase the number of questions it can respond to. related to cybercrimes such as money frauds.

REFERENCES

1. Kasthuri, E., and S. Balaji. "A chatbot for changing lifestyle in education." In 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), pp. 1317-1322. IEEE, 2021.

2. Biswas, Debmalya. "Privacy preserving chatbot conversations." In 2020 IEEE Third International Conference on Artificial Intelligence and Knowledge Engineering (AIKE), pp. 179-182. IEEE, 2020.

3. Santos, Giovanni Almeida, Guilherme Guy de Andrade, Geovana Ramos Sousa Silva, Francisco Carlos Molina Duarte, João Paulo Javidi Da Costa, and Rafael Timóteo de Sousa. "A Conversation-Driven Approach for Chatbot Management." IEEE Access 10 (2022): 8474-8486.

4. Miklosik, Andrej, Nina Evans, and Athar Mahmood Ahmed Qureshi. "The use of chatbots in digital business transformation: a systematic literature review." IEEE Access 9 (2021): 106530-106539.

5. Ren, Ranci, Mireya Zapata, John W. Castro, Oscar Dieste, and Silvia T. Acuña. "Experimentation for chatbot usability evaluation: A secondary study." *IEEE Access* 10 (2022): 12430-12464.

6. Chakraborty, Sanjay, Hrithik Paul, Sayani Ghatak, Saroj Kumar Pandey, Ankit Kumar, Kamred Udham Singh, and Mohd Asif Shah. "An AI-Based Medical Chatbot Model for Infectious Disease Prediction." *IEEE Access* 10 (2022): 128469-128483.

7. Denecke, Kerstin, Sayan Vaaheesan, and Aaganya Arulnathan. "A mental health chatbot for regulating emotions (SERMO)-concept and usability test." *IEEE Transactions on Emerging Topics in Computing* 9, no. 3 (2020): 1170-1182.

8. Cameron, Gillian, David Cameron, Gavin Megaw, Raymond Bond, Maurice Mulvenna, Siobhan O'Neill, Cherie Armour, and Michael McTear. "Towards a chatbot for digital counselling." In *Proceedings of the 31st International BCS Human Computer Interaction Conference (HCI 2017) 31*, pp. 1-7. 2017.

9. Abd-Alrazaq, Alaa A., Mohannad Alajlani, Ali Abdallah Alalwan, Bridgette M. Bewick, Peter Gardner, and Mowafa Househ. "An overview of the features of chatbots in mental health: A scoping review." International Journal of Medical Informatics 132 (2019): 103978.

10. El Hajal, Georges, Roy Abi Zeid Daou, and Yves Ducq. "Human Firewall: Cyber Awareness using WhatApp AI Chatbot." In 2021 IEEE 3rd International Multidisciplinary Conference on Engineering Technology (IMCET), pp. 66-70. IEEE, 2021.

11. Ausman, Michelle C. "Artificial Intelligence's Impact on Mental Health Treatments." In Proceedings of the 2019 AAAI/ACM Conference on AI, Ethics, and Society, pp. 533-534. 2019.

12. Fitzpatrick, Kathleen Kara, Alison Darcy, and Molly Vierhile. "Delivering cognitive behavior therapy to young adults with symptoms of depression and anxiety using a fully automated conversational agent (Woebot): a randomized controlled trial." JMIR mental health 4, no. 2 (2017): e7785.

13. Vandebosch, Heidi, Alina Botezat, Anna Lisa Amodeo, Sara Pabian, Piotr Plichta, Zrinka Puharic, and Jacek Pyzalski. "A scoping review of technological interventions to address ethnicity-related peer aggression." Aggression and violent behavior (2022): 101794.

14. Nataliya B. Sukhai. 2004. Hacking and cybercrime. Proceedings of the 1st annual conference on Information security curriculum development (InfoSecCD '04). Association for Computing Machinery, New York, NY, USA, 128–132. https://doi.org/10.1145/1059524.1059553.

15. Koulouri, Theodora, Robert D. Macredie, and David Olakitan. "Chatbots to Support Young Adults' Mental Health: An Exploratory Study of Acceptability." ACM Transactions on Interactive Intelligent Systems (TiiS) 12, no. 2 (2022): 1-39.

16. Ellis, Shawn. (2019). A Qualitative Heuristic Study of Adult Cyberbullying in Higher Education. 10.13140/RG.2.2.34931.68642.