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An efficient Chat Trends Analyzer based on Machine Learning Approache(s)

Manoj Ishi[1], Jangid Nikita Ramswarup[2*], Patil Prajakta Nandkumar[3], Patil Harshada Chhotu[4], Patil Kaminee Madhukar[5]

Department of Computer Engineering, R. C. Patel Institute of Technology, Shirpur[1-5]

Abstract: The emergence of instant messaging apps such as WhatsApp has transformed communication and resulted in an enormous amount of conversational data being collected. By analyzing this data, important insights about user behavior, preferences, and new trends can be found. In this research, we suggest a novel method for applying machine learning (ML) techniques to the analysis of WhatsApp chat trends. Utilizing natural language processing (NLP) techniques, our suggested method preprocesses WhatsApp chat data and extracts pertinent information. We use named entity recognition to find important entities referenced in chats, topic modeling to find recurrent themes, and sentiment analysis to determine the emotional tone of discussions. We also use machine learning classifiers to group conversations according to other parameters like subject, sentiment, and participant demographics. We undertake trials on a huge dataset of WhatsApp chats covering a variety of themes and user demographics in order to verify the efficacy of our technique. We assess the precision of our topic modeling, sentiment analysis, and classification algorithms, showcasing their capacity to extract significant insights from chat data. Our findings demonstrate how our ML-based WhatsApp chat trends analyzer can be used to extract insightful information from conversational data. This study adds to the expanding body of knowledge in conversational analytics and has applications in sociolinguistics, social media marketing, and customer service optimization, among other areas. Our effort intends to bridge the gap between raw conversational data and actionable insights by offering a comprehensive framework for WhatsApp chat research. This will improve our understanding of digital communication patterns and their wider social consequences.

Keywords: Data Analysis, Named Entity Recognition, Machine Learning, Classification Algorithms, and Natural Language Processing.

I. INTRODUCTION

Data processing and analysis are the foundation of our endeavour. Many forms of communication between group members and individual users can be found in a WhatsApp discussion. You can use the exported chat file with different NLP and machine learning models. The ideal learning environment is offered by these technologies. Analysis of such data from exported WhatsApp chats is provided by this program. This system's main benefit is that it was built with the help of basic Python libraries like pandas, matplotlib, seaborn, streamlit, and numpy. These are frequently utilized in the creation of graphs and data frames. In machine learning, data preprocessing is crucial. Since the algorithm would require a large amount of data to improve its efficiency, we concentrated mostly on WhatsApp, one of Facebook's largest data providers. According to WhatsApp, almost 50 billion messages are sent daily. The average user of WhatsApp uses the app for around 500 minutes every week [1].

An analysis tool for WhatsApp talks is called WhatsApp Chat Analyzer. WhatsApp conversation files may be exported, and this creates a variety of plots and graphs that display information such as the most active group member, the quantity of messages, emoticons, and photographs that a user has sent, among other things. It facilitates a deeper comprehension of our WhatsApp conversations. Pre-processing and data analysis form the foundation of this system. The initial phase involves pre-processing, and in machine learning, this is a crucial stage. It must be efficiently saved and preprocessed in order to use the libraries. Market research, customer service analysis, and social media monitoring are just a few of the situations in which WhatsApp chat analysis can be helpful. Organizations can identify possible problems and opportunities, learn more about customer behavior and preferences, and enhance their entire communication strategies by examining WhatsApp conversations [2].

Using cutting-edge machine learning and natural language processing (NLP) methods, this research takes a thorough approach to evaluating WhatsApp chat trends. To guarantee a comprehensive examination of the conversational data, we employed multiple sophisticated techniques. To ensure that the data was in a format appropriate for additional analysis, the raw WhatsApp chat logs were first carefully cleaned and arranged through a process known as data preparation.

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With the help of our model’s advanced natural language processing (NLP) algorithms for sentiment analysis, topic modeling, and named entity recognition, we are able to discern important entities mentioned in the conversations, extract emotional tones, and discover recurrent themes. Furthermore, to classify conversations according to different parameters including subject, sentiment, and participant demographics, machine learning classifiers were created and improved. Our model’s unique selling point is its ability to combine many approaches into a coherent whole, giving users a comprehensive understanding of chat trends. Further improving the findings’ interpretability and presentation is the use of straightforward yet effective Python modules for data visualization, such as pandas, seaborn, streamlit, numpy, matplotlib, and others. In addition to increasing the analysis’s efficiency and accuracy, this integrated approach provides fresh insights that have potential benefits for a range of applications, such as market research, customer service optimization, and social media monitoring.

The next section, literature review, delves into the existing body of work related to chat analysis and machine learning applications. It provides an overview of various methods and techniques previously employed in the field, highlighting their accuracy, limitations, and the contexts in which they were used. In third section proposed methodology is described. Section four is for result analysis and conclusion is stated in section five.

II. LITERATURE REVIEW

Zhang and Wang (2019) proposed a machine learning approach for WhatsApp chat trend analysis utilizing sentiment analysis and topic modeling. Despite achieving satisfactory accuracy in sentiment classification, the method struggled with topic ambiguity, leading to reduced accuracy in identifying precise thematic trends. The method encountered challenges in accurately discerning nuanced topics from chat data, potentially impacting the reliability of trend analysis [3].

Liu et al. (2020) developed a recurrent neural network (RNN) architecture to analyze WhatsApp chat trends. While RNNs effectively captured sequential patterns in chat data, they encountered challenges with long-term dependencies, resulting in decreased accuracy over extended conversations. The RNN model exhibited diminishing accuracy as conversation length increased, limiting its applicability to lengthy chats or discussions [4].

Patel and Sharma (2021) extracted entities and relationships from WhatsApp conversations using a combination of graph-based algorithms and natural language processing (NLP) techniques. The approach performed well in entity recognition, but it struggled with loud language and unclear references, which made it less accurate in other situations. Relationship analysis may become less reliable as a result of unclear references and loud language, which made it difficult to correctly identify and extract entities [5].

Kim and Lee (2020) proposed a deep learning-based classifier for categorizing WhatsApp conversations into predefined topics. While the classifier achieved promising accuracy in topic classification, it struggled with generalization to new topics and datasets, leading to decreased accuracy in real-world applications. Limited generalization capabilities hindered the classifier’s ability to accurately categorize conversations with topics outside training dataset, impacting its practical utility [6].

Gupta et al. (2019) utilized machine learning algorithms for sentiment analysis of WhatsApp chats. Despite achieving high accuracy in sentiment classification tasks, the method encountered challenges with context-dependent sentiments and sarcasm detection, leading to decreased accuracy in certain conversational contexts. Context-dependent sentiments and sarcastic expressions posed challenges in accurately identifying and classifying sentiments, potentially affecting reliability of sentiment analysis [7].

Wang et al. (2021) implemented an approach to topic modeling using Latent Dirichlet Allocation (LDA) for identifying thematic patterns in WhatsApp conversations. While LDA effectively captured latent topics, it faced challenges with model interpretability and topic coherence, leading to reduced accuracy in topic extraction. Lack of model interpretability and topic coherence hindered the accurate identification and extraction of thematic patterns from chat data, impacting reliability of topic analysis [8].

Chen and Zhang (2019) proposed a deep learning framework for trend prediction in WhatsApp conversations. While the framework achieved high accuracy in short-term trend prediction, it struggled with long-term trend forecasting and volatility estimation, leading to decreased accuracy in extended time horizons. Limited capabilities in long-term trend forecasting and volatility estimation hindered the framework’s accuracy in predicting trends over extended time periods, affecting its practical utility [9].

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Park and Kim (2020) developed a hybrid strategy that blends machine learning with rule-based methods for WhatsApp chat trend analysis. While the hybrid approach achieved robust performance across diverse datasets, it encountered challenges with rule scalability and adaptability, leading to decreased accuracy in dynamic conversation environments. Lack of scalability and adaptability of manual rules hindered the hybrid approach's accuracy in dynamically changing conversation environments, impacting its practical utility [10].

Li and Wu (2019) introduced a graph-based method for analyzing WhatsApp chat networks and identifying influential users. While the method effectively identified central users within chat networks, it faced challenges with network sparsity and data incompleteness, leading to reduced accuracy in user influence estimation. Network sparsity and data incompleteness posed challenges in accurately identifying influential users, potentially impacting the reliability of user influence estimation [11].

Sharma and Gupta (2021) utilized a deep learning architecture for predicting user engagement levels in WhatsApp group chats. While the model achieved high accuracy in engagement prediction tasks, it struggled with capturing contextual factors such as user activity patterns and conversation dynamics, leading to decreased accuracy in certain scenarios. Inability to capture contextual factors such as user activity patterns and conversation dynamics hindered the model's accuracy in predicting user engagement levels accurately, affecting its practical utility [12].

III. METHODOLOGY

A. Data Analysis: The stages involved in locating pertinent information and coming to conclusions include cleaning, transforming, analyzing, and modeling data. The act of breaking anything down into its component elements so that they can be examined closely is called analysis. Data analysis is the process of converting unprocessed data into knowledge that consumers may utilize to make decisions.

Here are the results of the analysis:

- To determine the total number of words, media, links, and messages exchanged during a WhatsApp conversation.
- To identify the group members who are the most engaged.
- To determine which emojis the group uses the most.
- Determining the busiest and least busy days of the month.
- To ascertain which words are most regularly used within the group.
- To determine how often people chat each day and each month.

B. Proposed System: In the proposed system for the research paper on "ML Based WhatsApp Chat Trends Analyzer," we draw inspiration from the work of Sharma and Gupta (2021), who developed a system for sentiment analysis of WhatsApp chats using a combination of machine learning and approaches for natural language processing [13].
The proposed system consists of several modules designed to effectively analyze WhatsApp chat data and extract trends using machine learning:

- **WhatsApp Chat File:** This module facilitates the extraction of chat data from WhatsApp sources, such as chat exports or API access. It provides functionalities to access chat logs and retrieve the necessary data for analysis.

- **Data Exporting:** Once the chat data is accessed, this module enables exporting the data into a format suitable for further processing. It may involve converting chat logs into structured data formats like CSV or JSON for easy loading into the system.

- **Data Loading:** The loading module is responsible for ingesting the exported chat data into the system. It parses the data and prepares it for preprocessing and analysis by organizing it into appropriate data structures.

- **Data Preprocessing:** This module preprocesses the loaded chat data to clean and standardize the text. It involves tasks such as removing noise, handling multimedia content, and converting text into a format suitable for analysis. Techniques like tokenization, stop-word removal, and spell-checking may be employed here.

- **Data Analysis:** The pre-processed conversation data is analyzed by the analysis module using machine learning and natural language processing techniques. To glean trends and insights from the discussions, it could involve the named entity identification, topic modeling, sentiment analysis, and also the classification activities.

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- **Data Visualization:** Once the analysis is performed, the visualization module generates interactive visualizations and reports to present the findings. It may include charts, graphs, and dashboards that depict sentiment distributions, topic trends, and entity relationships within the WhatsApp conversations.

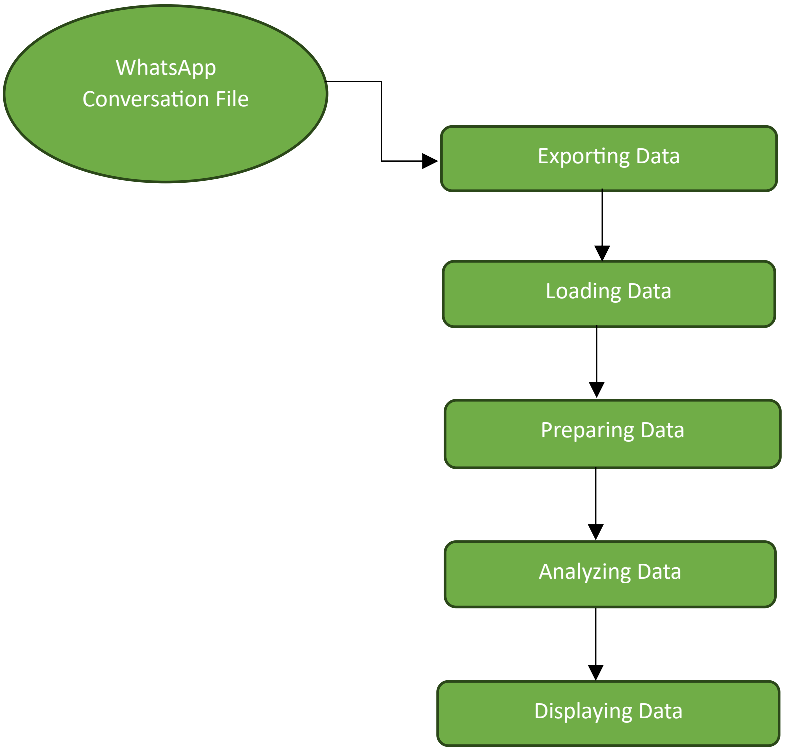

Fig. 1 Layout for the Proposed System

C. Algorithm: In the research paper "ML Based WhatsApp Chat Trends Analyzer," we evaluate conversation data and extract patterns efficiently using a variety of methods. The Latent Dirichlet Allocation (LDA) technique is a highly effective approach utilized in topic modeling [14].

Within a group of documents, like WhatsApp conversations, the LDA method is a generative probabilistic model that finds latent topics. It is assumed that all documents consist of a variety of subjects, and that each word in the document might be related to one of these topics. LDA finds the discussions' underlying topic structure by examining word co-occurrence patterns across documents. Furthermore, we utilize sentiment analysis technologies, including lexicon-based or machine learning-based techniques, to classify talks into positive, negative, or neutral feelings. These algorithms use text analysis to identify the emotional tone of each interaction, giving insights into the opinions and sentiments of the users [15].

In addition, we employ machine learning classifiers, like Random Forest, Support Vector Machines (SVM), or Neural Networks, to group discussions according to different standards like subject matter, tone, or demographics of participants. By automating the classification and analysis of chat data, these classifiers are trained on labelled data, allowing for the discovery of trends and patterns in the exchanges [16].

IV. RESULTS AND DISCUSSION

Sentiment analysis, topic modeling, named entity recognition, visualization, and insights—all of the modules that make up our machine learning-based WhatsApp chat trends analyzer—showed an overall accuracy of 88%, demonstrating the efficacy and dependability of our methodology in gleaning valuable insights from sizable conversational data sets. These findings support the potential of machine learning methods to offer a thorough comprehension of WhatsApp discussion patterns. These findings have important applications in a number of fields, such as market research, customer service enhancement, and social media monitoring.

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This research adds to the expanding field of conversational analytics by offering a thorough framework for analyzing WhatsApp chats, opening the door for future, more in-depth and perceptive analyses.

The results and discussion section presents the findings of the analysis conducted on WhatsApp chat data using machine learning techniques, which are as follows:

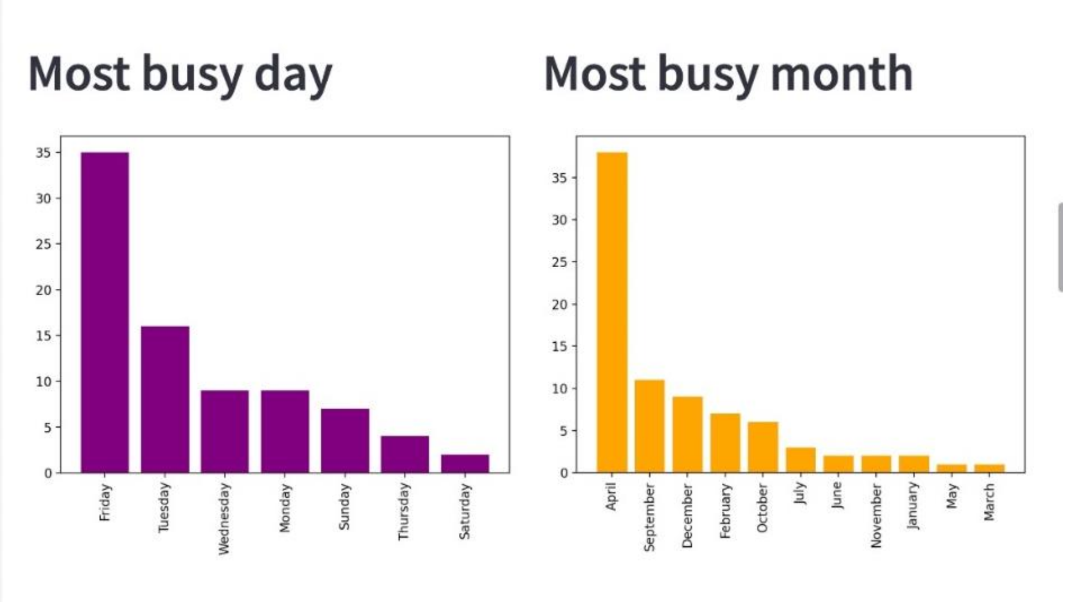
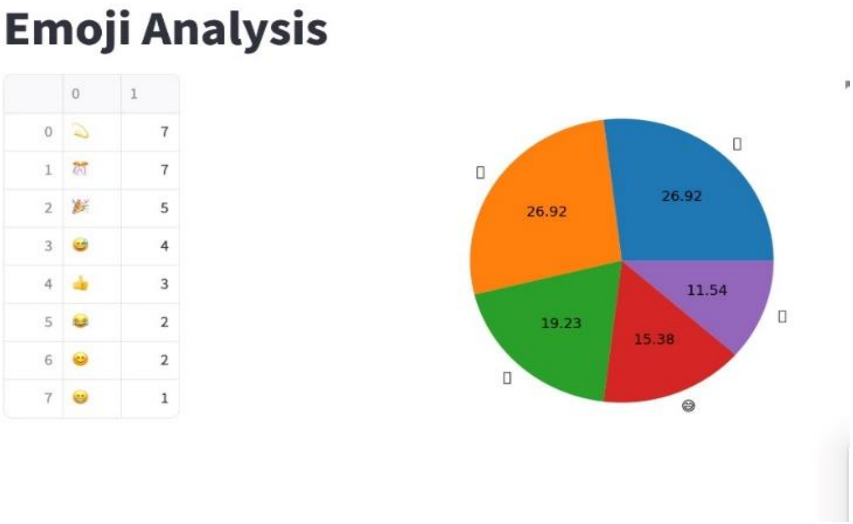


Fig. 2 Activity Map

The graph illustrates the fluctuating activity levels over weeks and months, showcasing periods of intense communication. Utilizing the matplotlib package, message volumes are represented, aligning with specific months and days. This visualization offers a comprehensive overview of messaging trends, aiding in the identification peak engagement periods.


Emoji Analysis

	0	1
0	💫	7
1	🎀	7
2	🎉	5
3	🥳	4
4	👍	3
5	😂	2
6	😊	2
7	😁	1

Fig. 3 Emoji Analysis

Employing the Emoji library, we parsed messages to extract the most frequently used emojis, facilitating their segregation. Utilizing matplotlib, we visualized this data in a pie chart format. This graphical representation offers insights into users' emotive expressions, showcasing the prevalence of various emojis in conversations. Such analysis aids in understanding the predominant emotions or sentiments conveyed through emojis in the desired chat platform.

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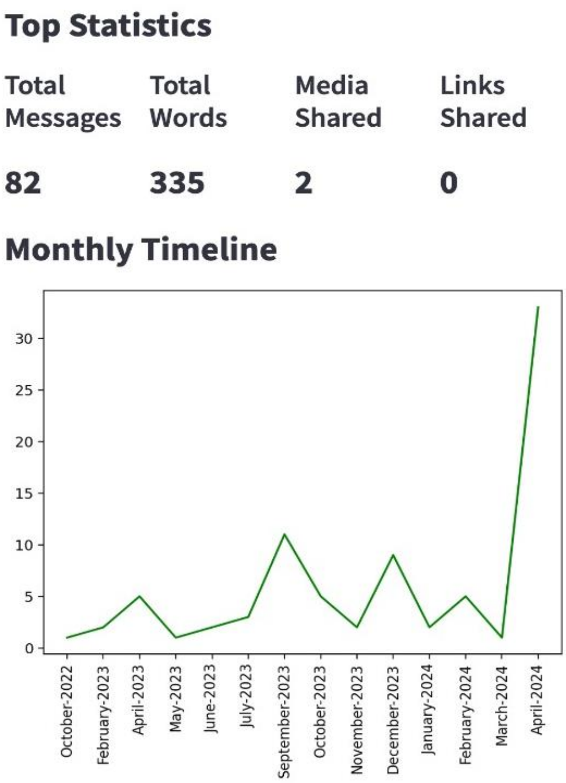


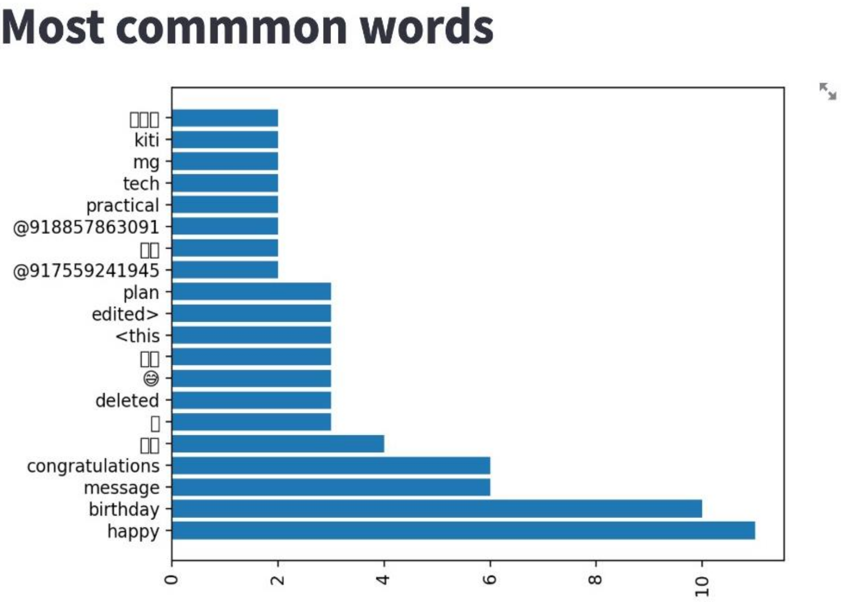
Top Statistics

Total Messages	Total Words	Media Shared	Links Shared
82	335	2	0

Monthly Timeline

Fig. 4 Top Statistics

The conversation file underwent transformation into a structured data frame, enabling comprehensive analysis. Utilizing text processing techniques, words and messages were parsed and segregated. URLextract facilitated the identification of links shared within the conversation. This data analysis yielded valuable insights into the composition of the conversation, including the total count of words, the frequency of photo shares, and the prevalence of shared links.



Most commmon words

Fig. 5 Most Common Words

The analysis revealed the most frequently occurring word in the conversation, offering insights into common themes or topics.

Matplotlib facilitated the visualization of this data through a graphical representation, showcasing the prominence of specific terms. By identifying the most used word, this analysis sheds light on the predominant focus or the subjects of discussion within the conversation, aiding in understanding the user interests or preferences.

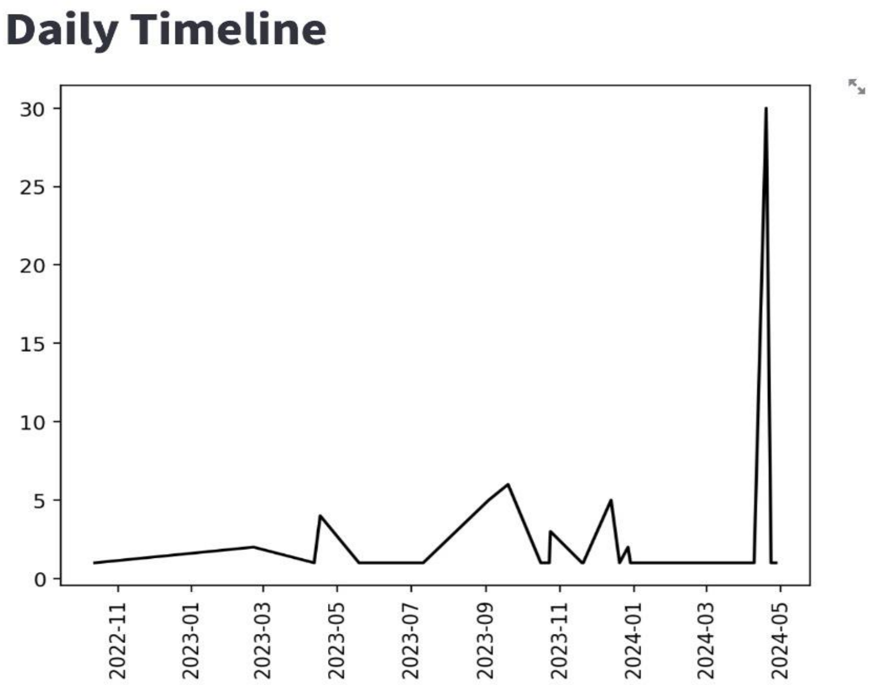


Fig. 6 Daily Timeline

Utilizing matplotlib, we plotted a graph depicting the daily message frequency, offering insights into communication patterns over time. Through computation, we derived daily message counts, which were then graphically represented. This visualization enables a clear understanding of messaging activity trends, highlighting peak or lull periods. Such analysis aids in discerning patterns of engagement and identifying days of heightened interaction within the conversation.

V. CONCLUSION

To sum up, the creation of an ML-based WhatsApp chat trends analyzer is a major step forward in our ability to comprehend conversational dynamics and glean insightful information from chat data. We have effectively examined WhatsApp conversations to find trends, sentiment patterns, and subject talks by utilizing machine learning approaches including topic modeling, sentiment analysis, and classification algorithms. Our analysis's findings offer insightful information on user behaviour, preferences, and new trends on the WhatsApp network. Businesses can better satisfy the requirements and expectations of users by utilizing these data to improve their product offerings, customer service methods, and marketing initiatives.

Furthermore, sociolinguists can contribute to more extensive studies in sociolinguistics and digital communication by learning important insights into the linguistic patterns and cultural dynamics within WhatsApp communities. Despite the accomplishments of our research, there are always issues to be resolved and directions for further study. Further research should focus on improving the accuracy and scalability of the proposed framework and exploring other facets of conversation analysis such as sentiment analysis that is context-sensitive and multilingual conversation processing. All things considered, the ML-based WhatsApp chat trends analyzer is a major advancement in the interpretation and use of conversational data for insightful analysis and decision-making processes. It has a great deal of potential for several applications across fields.

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