

A NOVEL TDEF1.0 FOR MAKING TWITTER ACCESSIBLE FOR PEOPLE WITH DISABILITIES

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ABSTRACT

This manuscript introduces a novel framework to extend the accessibility of Twitter users' timelines to people with disabilities. Our proposed framework is designed with iconic speaker and information functionalities which will enable transcription of multi-media content and provide users the opportunity to read and hear the translated transcripts depending upon the user's primary language.

This work is one of its kind that opens Twitter's user timeline completely to people with disabilities.

KEYWORDS

Disabled people, Accessibility, Twitter, Transcription, TDEF1.0.

INDEX

ABSTRACT

KEYWORDS

1. TWITTER FOR EVERYONE

2. AN ANALYSIS OF THE CURRENT TWITTER FRAMEWORK

2.1. Current Timeline features

3. PROPOSED TWITTER DATA EXTRACTION FRAMEWORK (TDEF 1.0)

3.1. Voice Tweet

3.2. Video Tweet

3.3. Image/Gif Tweet

3.4. Text Tweet

4. IMPLEMENTATION DETAILS

4.1. Extraction of Tweets

4.2. Transcription

4.3. Image Captioning

4.4. Text Summarization

5. RESULTS

6. CONCLUSION

7. FUTURE SCOPE

REFERENCES

ABOUT THE AUTHORS

1. TWITTER FOR EVERYONE

Among the various social media platforms [8], Twitter is considered one of the popular microblogging services on the internet which allow users to post (tweet), like, comment and share (retweet) [2].

Twitter has over 3.5 billion monthly active users [4],[18]. This number is growing each day as Twitter is continuously improving its global accessibility to share real-time information among members of the public and is thus widely impacting business, politics, communities, social groups, etc [10],[18].

At the basic, Twitter makes its features accessible to all its users with options to create content in audio, video, text, image, or URL formats [3]. This feature is included with the purpose to widen the outreach of Twitter content among a wide audience including the blind or people with vision abnormalities [20].

Twitter being an internationally recognizable platform, follows a format for appropriate appearances and limited functionality [3]. It also introduced certain features to improve its content accessibility, like [21].

1. In 2017, the limit of text-tweet got doubled from 140-character-limitation to 280.
2. As of May 2020, Alt-Text for captioning images to improve the accessibility of Twitter timelines for visually impaired people is enabled by default on Web, iOS and Android app users [5].
3. Voice tweets were rolled out as an experiment, which was limited to iOS devices to improve the accessibility of content to the audience [29].

However, as per analysis, the new Twitter features are either extended versions of existing features or are limited to several users [25].

Hence, though efforts are being made to open the boundaries of Twitter to people with disabilities, challenges remain [17],[21].

This manuscript proposes a novel solution to widen the feature functionality of Twitter, ensuring easy access to all potential users with varied types and degrees of disability.

The manuscript proposes to increase the participation of people with disability through the inculcation of novel features like text-to-speech (Read out loud tweet), image captioning (Image summarization), speech-to-text (Video/Audio tweet captioning), etc. To highlight the same, the rest of this manuscript is structured as follows. Section ii analyses the existing Twitter framework concerning the timeline features. Section iii outlines the proposed Twitter Data Extraction Framework (TDEF). Section iv details the implementation details of the same. Section v reports the results of testing the same while Sections vi and vii conclude the manuscript by elaborating our understanding of the same and our future course of action to address further research challenges.

2. AN ANALYSIS OF THE CURRENT TWITTER FRAMEWORK

Twitter is one of the most popular global social networking platforms [4]. Hence before suggesting any enhancements to its features, it is first important to understand its current capabilities [8]. We review the same in this section, especially concerning the timeline feature.

2.1. CURRENT TIMELINE FEATURES

Twitter displays a structured timeline with a stream of real-time tweets from the accounts that are followed by any user [18]. It also provides options to view the top tweets or the latest tweets first in the timeline [2]. The major goal of the user timeline is to display the content the user is most interested in and would contribute to the same [7].

As per their most popular historical features –comments and retweets made a huge success in the engagement of potential users with the content [3]. To further improve accessibility, recently the timeline got an extension with follow-up features, like [21]:

1. Anonymous Bookmark [26]: Introduced to avoid the problem of liking, retweeting and spamming. Enabled users to purposely refer to the tweets later. Bookmarked content remains private as no one can see who saved and what is saved.
2. Direct Message (DM) [11]: Allows private sharing of tweets through DM (Direct message) or any social platform. It applies the copy link feature to copy the URL into the clipboard. The reach of tweets is now amplified to varied platforms like SMS, Email, etc outside of Twitter to stabilize its online presence.
3. Twitter Fleets [23]: Enables sharing transitory thoughts through your tweet, text, videos, gifs, and photos for 24 hours. Inspired by Instagram and Facebook, it is a dynamic, personalized approach rolled out to share moments for a short period and see who viewed the content.
4. Voice Tweets [16],[27]: Enabled tweets to be published with audio options that people could play.

The above-listed features are only a few of the most notable ones [12],[16]. However, we noticed that the Alt-text option, which enabled limited image description for visually impaired people expanded the number of potentially active users on Twitter [12],[22],[24] Hence, the current updated timeline of Twitter supporting people with disabilities is detailed in Table 1 below:

Table 1. Twitter support for people with disabilities

Disability	Voice	Video with Speech	Image	Text
Visual (Blind/ Colour Blind/ Visually Impaired)	-	Under Trial	Alt-Text (optional)	Alt-Text (optional)
Voice (Deaf/ Hearing Impaired)	Under Trial	Under Trial	-	-
Reading (Dyslexia)	-	-	-	-
Language (non- natives)	-	-	-	Text Translation (through Google)

As is clear from Table 1, for people with disabilities, Twitter has made some inbuilt support [24]. For multi-lingual users, auto-translation for text tweets is also rolled out powered by Google to help users to engage with translated content in a meaningful way [16]. The same is depicted in Fig.1 below:

**Figure 1.** A tweet featuring Auto-translation into the user's primary language

Popular platforms like Facebook and LinkedIn have already implemented multiple features to increase the ability to access content like text, voice, video image/gif [10]. Thus, it is time Twitter should keep in mind that Twitter is for everyone and it is a room where potential users engage with content and raise their voice [21]. Thus, as one of its first, we have designed and implemented a novel Twitter Data Extraction Framework we have coined as TDEF1.0. This framework is intended to support

people with disabilities to join and use Twitter. The details of the same are elaborated in the following section.

3. PROPOSED TWITTER DATA EXTRACTION FRAMEWORK (TDEF 1.0)

As discussed in section ii, Twitter has various accessibility features for normal people [11],[12],[21],[23],[26],[27],[14],[18]. However, it is well realized that Twitter should improve its accessibility among physically challenged prospective users [17].

In the past for many years, Twitter limited its use to traditional features for content creation [13]. However, soon it began rolling out effective and engaging features to allow more users to interact with real-time information in a more meaningful way [21]. In 2015, Twitter introduced many extensions to its timeline to leverage usage and increase the number of active users [18]. However, after thorough timeline analysis we realized that despite efforts, Twitter has as yet failed to introduce any timeline enhancements that could bring people with disabilities easily on board. Though many disabled have been absorbed by Twitter, many still hesitate [17].

Thus, we propose a real-time approach to include disabled people on Twitter. Taking cue [15] and amplifying Twitter values for the people, our research majorly focussed on the accessibility of Voice, Video, Images and Text to support people with different challenges and allow them to express and present their opinions without any technical barriers. We now briefly explain our approach for different kinds of tweets:

3.1. VOICE TWEET

After Twitter's recent experiment of Voice tweets for the iOS app [11], users could tweet their voice using the voice icon. Users could initially record up to 140 seconds of audio. If the audio message was longer than 140 seconds, it will be automatically threaded up to 25 audio tweets. We realized that the feature could be made more inclusive for the disabled community through transcription and translation.

Through transcription, the user could read the text from the transcribed audio. Through automated translation captions, users could also read the text in different languages which would make audio tweets accessible to the hearing-impaired audience.

3.2. VIDEO TWEET

To make video tweets accessible, we performed operations to generate a vocal summary of video tweets with speech and without speech. Summarized text will help the users to engage with content in a short period in more customized ways.

3.3. IMAGE/GIF TWEET

When users tweet images there is an additional feature to compose descriptions to make the photos more accessible to people with disabilities including people who are blind and have low vision.

In the alt-text feature for photos, add a short description under the limitation of 1000 characters for the audience to understand the type of content and increase engagement in a personalized way. If posted, the description of the image won't be visible and edited but visually impaired people will have access to the alt-text description through screen readers [12].

To increase access to images globally, we developed the feature of vocal summary for the image on the timeline which will help the audience with disabilities to listen to the summary of activity performed in the images. This image summary will support people understand the background without depending on the audience to let them add descriptions in the alt-text feature.

3.4. TEXT TWEET

Traditional text tweeting was the historical feature launched by Twitter, the micro-blogging platform in 2006 [13]. The product emerged with the limitation of text tweets up to 140 characters which allowed the potential users to compose the content on the social media platform and interact with relevant audiences.

In 2017, Twitter doubled its character limit from 140 to 280 for the audience to share their real-time information in a more meaningful way with the support of 40 languages except for Japanese, Chinese and Korean (JCK) [18].

Using the 280-character tweet feature should not be limited to the audience without any physical challenges. Consider the audience globally with different languages and different disabilities. We thus developed Vocal Reading to let users listen to the tweet they wish for. This will enhance the accessibility creatively without focusing to see on the device. The feature shall also save the eyes from longer screen time.

4. IMPLEMENTATION DETAILS

Twitter has played a vital role in the field of content creation platforms and significantly attracted millions of users in the past two decades all over the world [9]. The world has witnessed the power of Twitter where leaders to teenagers have actively participated with tweets and led the reach of tweets to the trending section [15],[19],[20].

In the following section, we will propose a model where the visibility of the tweets will have a high reach to the potential audience which also includes people with disabilities like visually impaired, hearing impaired, etc.

Our model targeted videos, audio, text, photos, and gifs where we fetched real-time tweets from Twitter and stored them in the database using .CSV files containing text, media and URLs. Figure 2 below depicts a sample of the same.

We trained our model on the real-time tweets where we scrapped data in November 2020 and stored 1000 tweets which majorly included tweets including text, URL and media attachments.

4.1. EXTRACTION OF TWEETS

Real-time Tweets were extracted from Twitter using Twitter API (Application Programming Interface) to analyze and learn behavior, direct interaction, locations and other significant resources [28].

To analyze whether the multimedia and non-multimedia content will have more access to people with disability, we sampled 1000 real-time tweets using our 3-way technique described below in Figure 2.

As seen in Figure 2., Twitter API was used to generate authenticate credentials including keys and tokens. After successfully generating Twitter API V2 endpoints, real-time tweets are fetched to examine in the further model and stored in .CSV files.

The tweets were filtered based on their content type and data was cleaned of non-relevant information like emoji, incomplete links, unwanted symbols, extra spaces and retweets. Once cleaned, the significant labeled non-media information was stored in respective CSV files and media files were maintained separately.

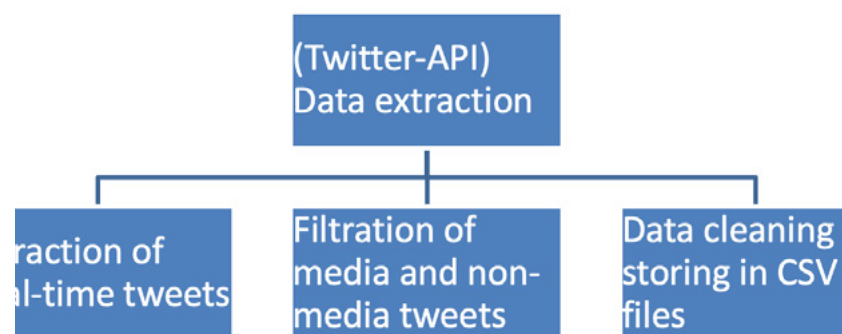


Figure 2. The 3-way technique for Data extraction using Twitter API

Table 2. The Statistic of extracted real-time Tweets – November 2020

Tweet Type	Number of tweets
Texts (iOS and Android)	400
Audios (iOS only)	30
Videos (iOS and Android)	230
Images (iOS and Android)	180
GIF (iOS and Android)	45
Text with URL (iOS and Android)	115

Table 2 above lists the statistic to better understand the behavior of extracted tweets, we have filtered the random sample of 1000 tweets from November 2020 according to the type of content where 400 tweets are text without any media attachments and 600 tweets are text with embedded multimedia where 30 tweets are audios by iOS users only, 230 tweets are videos with speech and without speech, 180 tweets are images, 45 tweets are GIF, 115 tweets are text with clickable URL.

4.2. TRANSCRIPTION

To explore the extent of Google services and API (Application Programming Interface), the most popular Google Cloud Speech-to-text API was used to convert Audio tweets and video tweets with speech into text which will be output as captions and subtitles respectively.

Separating tweets after data cleaning summed up to 260 tweets in total where 30-audio tweets and 230 video tweets were taken into consideration. The URL of the audio and video (with speech) were imported from the CSV files and after researching the frequency of media type, 5 different categories were observed to see which type of content significantly added value to reach visually impaired audiences.

Table 3. Frequency of different categories of video -230 Tweets

Categorical Video content	Frequency
Videos	55.5 %
Speechless Video	7.8 %
Short Video Tweets	9.3 %
Advertisements	25.2 %
Videos with text/quotes	2.2 %

We examined different video contents where out of 230 tweets, Table 3 describes the frequency of occurrence of different tweets where 55.5 % of the potential audience

generally tweeted videos with an average length of 1 minute, 7.8 % of videos have no speech, 9.3% videos are short with an average length less than 1 minute, 25.2% videos are advertisement which is promoted by social brands and companies for global users, 2.2% are videos which are either quotes or universal facts/texts.

Considering video and audio tweets, noise filtration was performed to remove the unwanted audio and differentiate the original voice of the person.

Using the Google Speech-to-text API, the audio and videos were transcribed into text and displayed in the form of captions and subtitles to the user. This technique is thus proposed to increase the reach to hearing-impaired people where earlier the videos were less accessible to people with hearing and vision problems. Our code also facilitates Google translation with the support of almost 108 languages that can translate the captioned transcribed text into their native language.

4.3. IMAGE CAPTIONING

Image captioning is one of the most popular features in the open-source communities and Industry [9]. Caption generation is an implementation of Deep Learning in which the model is processed and generates captions or short descriptions concerning the trained model. There is a huge probability that the model will not return accurate captions or descriptions and for better results, a huge amount of labelled dataset is required.

Separating 180 real-time image tweets which were stored in CSV files in the form of tweet URLs, our model was prepared using open-source tools to caption different categorical images.

The model aimed to not depend on the author of the original tweet containing media contents to write a short description under a character size of 1000 in the ALT-TEXT feature. The image captioning model is an independent feature that will facilitate over millions of active users and remove the barrier of limited access and networking opportunities.

To examine which part of the photo is detected to generate the caption, an Attention-deep learning model which is similar to the 'Show, Attend and Tell' paper was used [1],[30]. The model was trained using the MS-COCO dataset [6] with 40,000 images.

The deep learning InceptionV3 model was used as the feature extractor and then an encoder-decoder model was trained for the generation of desired captions/descriptions for new images.

4.4. TEXT SUMMARIZATION

Twitter is experimenting with media tweets containing audio and video for auto-captioning. Considering the testing feature of Audio tweets by Twitter for iOS users

and Video tweets for iOS and Android, our Text Summarization model is designed in support of the above Transcription model where audio and videos from tweets will be summarized into different language short sentences.

Open-source Python library, pysummarization is used that implements Encoder/Decoder based on LSTM (Long Short-Term Memory) for improving the accuracy of the desired summarization by Sequence-to-Sequence (Seq2Seq) learning.

Our proposed model is coded in a 3-step format which considered 260 tweets from CSV files.

1. The script reads the generated video/audio tweet transcript.
2. Summarize in not more than three sentences.
3. Display the summary to the audience.

The Text summarization model in support of the transcription model will work together to deliver the summary of the transcribed video/audio tweets. This will encourage active users to understand the content in the form of a summary and lead to meaningful interaction with other users.

5. RESULTS

The results obtained from the above experiment were motivating enough to infer that our model can significantly make an impact to fill the gap of content accessibility for people with disability.

The experiment has also removed the linguistic barrier by making the social media platform available to all in their specific native language.

As the current framework of Twitter supports features to the potential audience globally with an average of 6000 tweets per second which is approximately 200 billion tweets per year.

Further, our model is simple to operate as it can be implemented with a simple interface of only 2 buttons, namely: speaker icon (Read Out Loud) and information icon (transcript) which will help the disabled user to listen to the text tweets and read out the transcripts of multi-media contents like audio, video, image captioning and summaries. A simulation of the same is depicted in Fig. 3, 4 and 5 below.

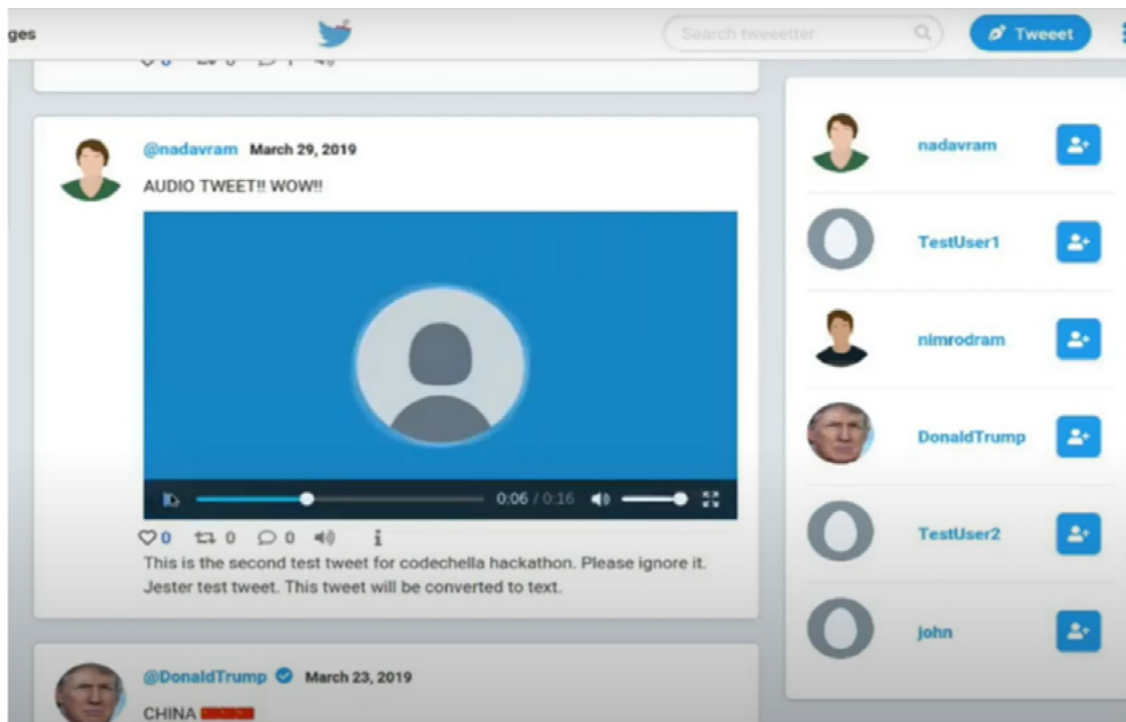


Figure 3. Transcription of Audio Tweet using Information Button ('i')



Figure 4. Transcription of Video Tweet followed by Summarization using the 'i' button.

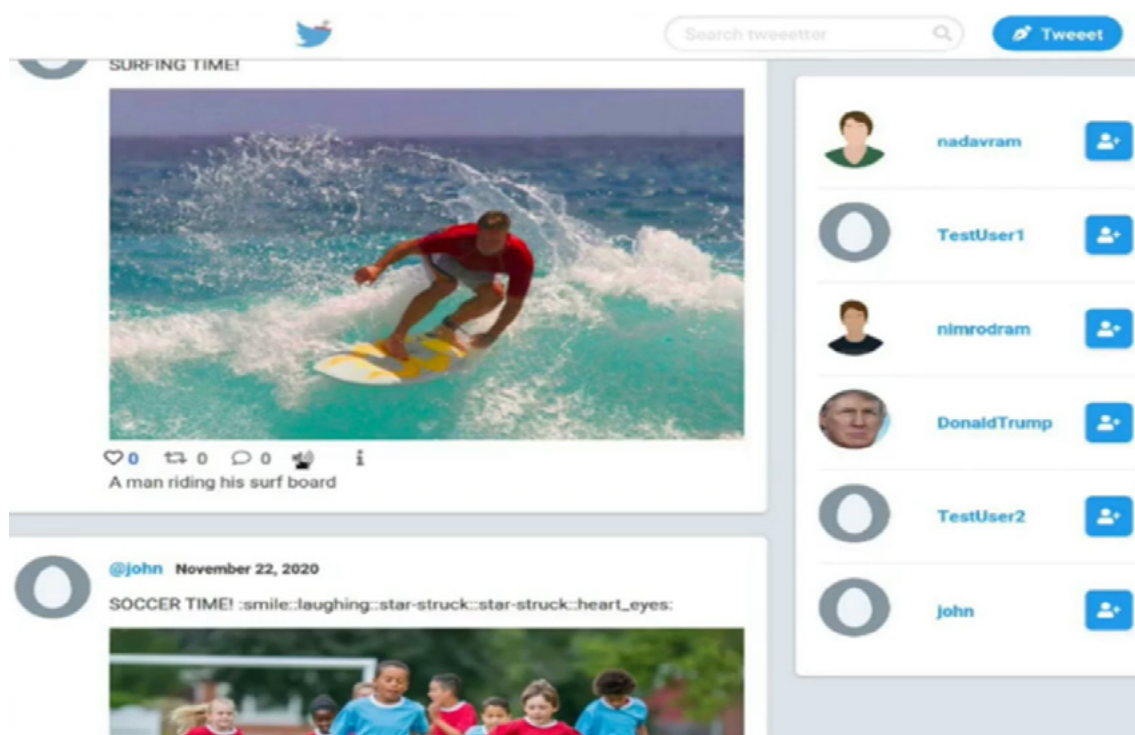


Figure 5. Read Out Loud Image caption using the speaker button

The above figures simulate our proposed framework for better accessibility of user timelines on Twitter. Two major icons knowingly as the speaker and information button support the proposed model which will leverage the open-source community along with communities for disabled people.

In Figure 2. the iconic information button will generate the transcript of the audio tweet and make it accessible majorly for hearing impaired people and other potential audiences. In Figure 3, a video tweet is transcribed through the information button followed up by a summary of the user's primary language. The transcribed text generated in Figure 4. after image captioning can be read out loud through the iconic speaker button which is also compatible in Figure 2 and Figure 3 respectively.

However, after obtaining results from our proposed model which implements Natural Language Processing, Transcription, Translation, and Summarization our approach of using the open-source library for transcript summarization may not yield better performance but there is always room for improvement and global contribution in the community.

6. CONCLUSION

In this research, we analyzed different types of disabled people who need access to Twitter with the advancement of technology and compared the existing features in the current framework of user's timeline with our proposed model which is specialized to fill the gap for disabled people community and leverage the value of inclusion and diversity.

The proposed model we coined as TDEF1.0, allows immediate access to the content and works independently without any indulgence of other people.

Concerning the current usage of Twitter by millions of active users, we have examined the pattern of tweets from our dataset of 1000 tweets that infer that people can improve their content creation style while keeping accessibility criteria in their mind.

Our study also suggests that people should be aware of some DOs and DON'T while creating and uploading content on social media platforms.

1. Active users should use camel case during Hashtags so that the screen reader can read the words separately like #EasyToRead.
2. Avoid using different fonts for a tweet as the screen reader will mess with the font name and actual word during screen reading.
3. Try to avoid using unnecessary emoji, special characters, abbreviations, GIFS, extra spaces, etc.
4. Always add an Alt-Text short description if any image is uploaded on Twitter.

7. FUTURE SCOPE

After researching Twitter for everyone, a possibility arises to make Twitter better every day with the advancement of technology and open-source tools. Our goal is to bring diversity and inclusion to the micro-blogging platform and uplift the power of disabled people.

In the future, we would want to bring focus on maintaining a dashboard for insights and statistics on the total number of accounts registered for people with disabilities to track their activities like the number of multi-media/ non-media tweets, retweets, replies, comments, likes in a year to generate overall usage of the product.

Twitter is filled with millions of bot accounts and a bot account can be advantageous to expand our support to the disabled people community by creating a support bot that will exclusively work during accessibility issues and prepares a report of the technical issues faced by the users on time.

Our research is supported by open-source technologies and considering the perspective of different audiences, more advancement and modifications can be done to make Twitter for everyone possible.

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