Bilkent University

CS491 Senior Design Project

ContentGuard

Project Specification Document

T2321

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Nov. 17, 2023

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1. Introduction

In an era dominated by the digital realm, social media platforms have become integral agents for information exchange. Among these platforms, Twitter stands out as a dynamic space characterized by its nonstop updates and diverse content. As individuals dive into the world of Twitter, they face the following challenges: navigating the expansive array of content effectively and managing the time devoted to engaging with Twitter.

The widespread use of social media, especially on platforms such as Twitter, has given rise to a prevalent issue: the unintentional dissipation of time on topics that may not align with users' primary interests or goals. As individuals traverse the endless stream of tweets, the risk of diverting attention to unrelated or unproductive content becomes increasingly apparent. In this setting, our senior design project evolves with the fundamental objective of empowering users to shape their social media experience.

The project arises from a modern challenge of finding the balance between the irresistible appeal of social media and the need for effective time management. With platforms providing an increasing variety of content, users frequently feel overwhelmed by a flood of information. Therefore, there's a need for a solution that not only helps to navigate content efficiently but also ensures control over digital interactions.

Recognizing the widespread nature of this challenge, our project aims to meet a fundamental requirement: the capability to regulate and personalize the Twitter experience. Users need a tool that goes beyond passive observation. They require a proactive solution that assists in managing their digital engagement actively. The goal is not merely to monitor user activity but to provide a set of features that empower individuals to create a purposeful and intentional journey on Twitter.

As we explore the details of our project, the Twitter Content Tracker, our goal is to encourage innovation, user-centric design, and a dedication to transforming the dynamics of social media interaction. By fostering a mutually beneficial relationship between users and their Twitter experience, our project aims to initiate a new era of mindful digital engagement.

1.1 Description

The Twitter Content Tracker aims to redefine how users engage with social media, particularly on Twitter. The main goal of the project is to create a content tracker that not only observes user activity but also introduces new features for optimizing the time users spend on the platform.

This innovative tool is geared towards offering users a more personalized experience by intelligently tracking their browsing habits and categorizing content based on individual interests. Unlike traditional observation, our content tracker empowers users to actively filter out undesired content, thus allowing for a more tailored and focused experience.

Moreover, the tool goes beyond mere observation, generating insightful reports on users' browsing patterns. This feature provides users with a comprehensive overview of the

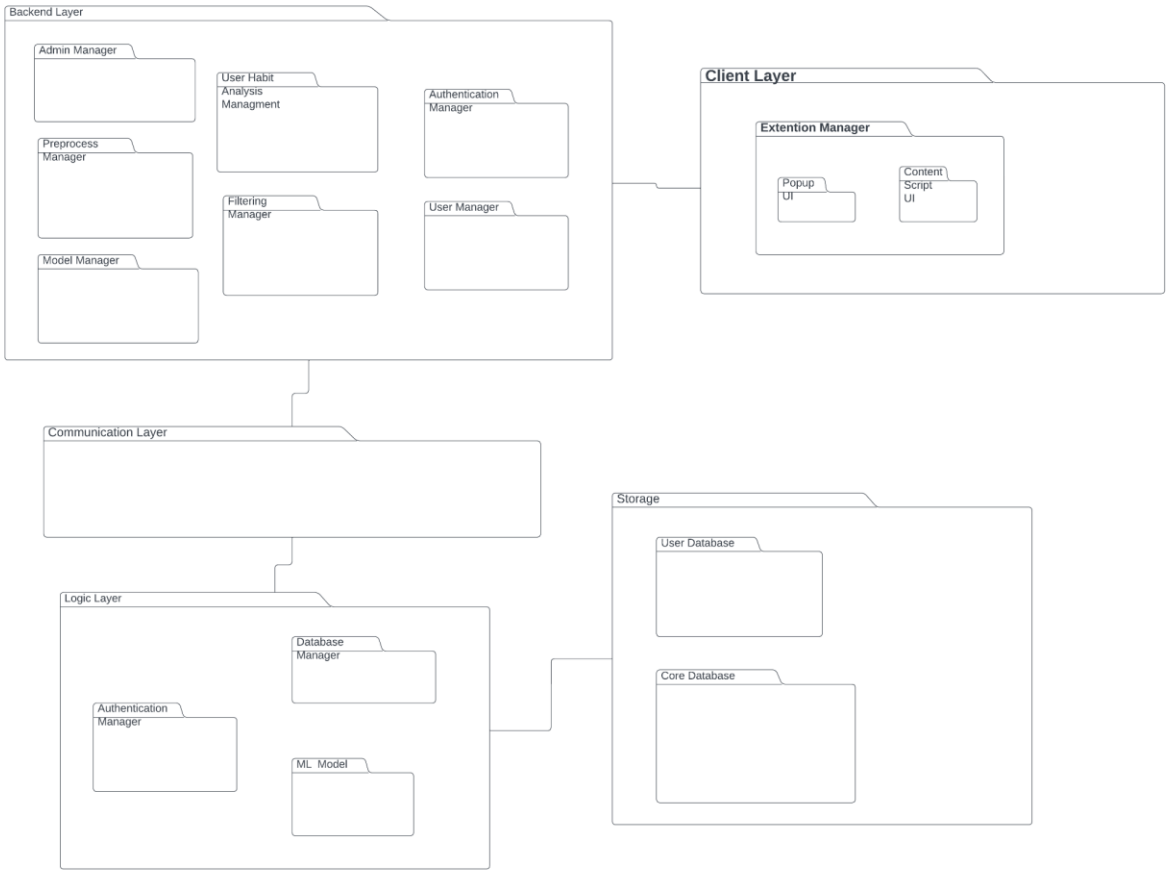
predominant topics and categories on their timeline, promoting self-awareness and aiding in content curation.

Recognizing the importance of time management, our content tracker puts the control in the hands of users, allowing them to set flexible time limits for their Twitter engagement. This not only facilitates a more intentional use of time but also encourages users to make conscious decisions about their digital interactions.

To further improve the social media experience, users can establish specific restrictions based on categories and keywords. This feature ensures that users engage with content that aligns with their interests, contributing to a more refined and purposeful social media interaction.

In essence, the Twitter Content Tracker aims to empower users by providing detailed control over their social media experience, facilitating a more personalized, efficient, and purposeful engagement on the Twitter platform.

1.2 High Level System Architecture & Components of Proposed Solution



1.2.1 Client Layer

- Extension Manager:

  This extension manager is responsible for dealing with interactions between two UI structures, Popup UI and Content Script UI. And It manages their connection to other layers.

- Popup UI:

  Enables users to set content filters. Also Provides them with timer controls restricting their interaction time with specified content types. Display the prepared reports for the user. Also provides access points for account settings.

- Content Script UI

  Intervenes with the Twitter interface to display the filtered content. Allows users to click words and hashtags to create filters.

1.2.2 Backend Layer

The backend layer is responsible for getting client requests from the communication layer and performing several actions according to the user's preference and settings.

- Admin Manager:

  This provides us, the developers, an entry point to modify the project. With this module, we can update the database and modify it for further improvements. This helps us to modify the database for the machine learning model with the connection from the authentication manager of the Logic Layer.

- Authentication Manager

  The authentication manager handles the user authentication functionalities. For example registering, signing in and out, and deleting the account. It handles any problems like forgetting password and email confirmation.

- User Manager

  The user manager handles the user functionalities. For example, profile, profile-related functionalities, and modifying and setting filter settings. And sends this preference to the database.

- User Habit Analysis Manager

  The user Habit Analysis Manager handles the preparation of reports and analyzing functionalities. With the provided user data, it performs

necessary calculations, analyzes them, and displays them in an organized way.

- Filtering Manager

  It handles the content filtering operations on the user's Twitter feed with the user preferences. It handles the blocked tweets and is responsible for the flow of the Twitter feed of the user.

- Preprocess Manager

  Preprocess Manager processes the data gathered from the Twitter feed of the user. It prepares the data for the ML model's assessment. It modifies this data so it is in proper form for inputting the ML model.

- Model Manager

  Model Manager after the input data is processed by the preprocess manager, it tokenizes the data for cleaning and organizes it for the content assessment model. It coordinates with the preprocess manager for data preparation.

1.2.3 Communication Layer

Communication Layer handles the communication between the layers. It handles the client requests and data transfer of filtering settings between the backend and client layers. It provides a connection between the backend and logic layer for transferring prepared data for the ML model and using functionalities on the other layer. It also connects the backend with the logic layer for storing user preferences and account information.

1.2.4 Logic Layer

- Authentication Manager

  This manager has different purposes from the authentication manager of the backend layer. It handles the authentication for the developers and their access to the ML model. It also handles user permissions for data usage on the ML model.

- Database Manager

  This manager handles the databases, and it provides functionalities to modify and access them.

- ML Model

This module contains the ML model for dividing the data into content types. This ML model includes evaluation functionalities for assisting the filtering process.

1.2.5 Storage Layer

- User Database

  This database contains the user profile information and filtering settings.

- Core Database

  This database contains the critical data for the training and testing of the ML model. After the model was developed, it still has a crucial role in the ML model.

1.3 Constraints

1.3.1. Implementation Constraints

- Twitter API or web scraping will be used for gathering training data for the AI model.
- Datasets that are available on the internet can be used as well.
- Github will be used for version control. It will allow parallel working, cloud storage for code and code-related files, and possibly a running environment with Github Pages.
- Chrome browser will be used as the testing environment for the extension.
- AI models will be trained with Google Cloud servers and stored in the Firebase servers.
- User data is planned to be stored in a non-relational database such as MongoDB.
- A project tracker like Github Issues is to be used to plan the development process.

1.3.2. Economic Constraints

- Twitter API allows for pulling 10,000 tweets for $100/month and 1,000,000 tweets for $5;000/month. Hence, web scraping is the more feasible option.[1]
- Datasets that can be found online are usually free.
- The part of the Github functionality we will use is free.
- Chrome browser and its extension functionality for the Chromium-based browsers are free.
- Google services have special pricing models for educational purposes, making them feasible for this project.
- MongoDB is open-sourced and free.

1.3.3. Ethical Constraints

- The data we will get by processing the feed and users' information are confidential and won't be shared by third parties.
- The data will be stored in a secure place to protect user privacy.
- The data will not be stored so that its source can be linked.

- The data will be analyzed and grouped to minimize biases in the subject, and experts may be consulted for determination.
- The Ethics of the National Society of Professional Engineers will be followed by our team in this project [2].
- If some features are decided to be paid features or the subscription is added to the Twitter Content Tracker in the future by the development team, it is understood by us that the payments system should be secure, and the team will make their efforts to make it as such.

1.4 Professional and Ethical Issues

- While processing the feed of the user we will process the user's original paragraphs, sentences, and words, which are the product of their creative process. Because this data is sensitive and it is the user's right to share it, we will protect them and not share the data with any other third-party company, person, etc.
- We will store the data in a secure way to be professional in our act of protecting user's rights.
- When storing the login data for the user, we will store them securely and use hashes to store the passwords to increase privacy and security.
- After a user logs in to Twitter, we are considering giving the user more control by asking them if they want to launch the application or other measures of control like stopping the application for once choice and stopping for always choice might be given to the user.
- Also, after launching the application to be used by people on the internet, we will make documentation that shows the user to inform the user about these ethical constraints so that they can choose freely to download or not.

2. Design Requirements

2.1. Functional Requirements

- The user can register to the application and sign in.
- The user can activate the extension by clicking the activation button on the processing page content.
- The user can deactivate the extension by removing it, by disabling it or signing out.
- The user can delete their account.
- The user can set the filtering options for multiple content types.
- The extension can filter tweets from the tweet feed according to filtering settings by the user.
- The user can determine timer constraints for filtering content types.
- The extension will track the time spent on consuming different content types and be able to create a report and display it to the user.
- The extension will activate chosen filters when timer constraints are met for these content types.
- The user can select specific keywords or hashtags for filtering.

- The extension will remove a tweet that includes chosen keywords or hashtags from the user tweet feed.

2.2. Non-Functional Requirements

2.2.1. Usability

- The user interface should be clearly understood by the users and needs to not have a learning curve to ease the users into using it without worrying about the complexity of the user interface.

2.2.2. Reliability

- The project should be able to accurately categorize each interacted tweet's content.
- The project's servers should not be down for a long amount of time, that affects the users' experience.
- When an error occurs, the program needs to inform the user that an error occurred and if they want to report the error to us developers.

2.2.3. Performance

- The content tracker part of the project should be lightweight and not impact the user experience by slowing down the load time on Twitter.
- The report part of the project should not take too much time that users are turned down to use the extension, which is around 5-10 seconds at most.

2.2.4. Extensibility

- The project should be open to extensibility via adding new features to the project according to the feedback we are getting from instructors and the innovation expert.

2.2.5. Scalability

- Content Tracker will be introduced to Twitter first, but after completion of the Twitter extension, the project can be extended to other platforms such as Instagram, Youtube, Bluesky, etc.

3. Feasibility Discussions

3.1. Market & Competitive Analysis

Currently, in the market, some other Chrome extensions have some of the features of the app we aim to develop or features similar to ours. One of these apps is Habitlab, which is an open-source Chrome extension that aims to aid its users in improving their online habits. Similar to our project, it provides time tracking, which can track time on specific

websites and interventions to consumptions of these websites [3]. Various intervention methods are available in HabitLab and are customizable to the specific site [2]. Although it lacks the feature of differentiating content types that users consume on those websites. Interventions only apply to the whole site and not a specific content type on these sites. So this shows that the time tracking ability of our application is possible to do. However, due to its limitations, it is not a competition to our application as our plugin is Twitter focused, and we aim to have many additional features like filtering the content of users' feeds also because Habitlab has trouble differentiating users' content types, so it is an app that cannot be said to be absolutely preferable to our app in that area too. However, we intend to use this extension to reference designing our user interface and implement similar features.

Another similar application is [Twitter] Mute Keywords [4] is a browser modification that can mute words and phrases from Twitter. This is similar to one of our planned features. We also aim to filter content on Twitter to allow our users to focus on their desired topics more easily. The purpose of their services seems to be allowing their users to isolate themselves from the topics they don't want to see. We aim to do this permanently or temporarily on a schedule/plan. Therefore, the main differences in our approach are that we want to be smarter and more flexible while defining the topic to mute, and we want to provide choices to fine-tune the process, such as duration and schedule of the limitation, which is how our app is unique in this market.

Through our research, we found out one other application called Tweetlogix that provides a way to filter content like muting users or keywords, retweeters, and retweets[5]. However, this app was not thoroughly examined by our team as it is not available in our location, which is also a big limitation. There are also other limitations he has that we aim to get over within our application, like no time tracking and the limitation of keyword blocking's content filtering, which is overcome by our usage of AI to analyze the feed so that the posts are examined by their topic instead of keywords. This shows that in the market, our application has a way of showing itself more beneficial to users who aim for the features we provide more so, if we can overcome location limitations.

There is also an application called TweetDeck, which has the limitation of being only available in ChromeOS although it enables users to customize the dashboard, schedule the tweets they post, and mute keywords and users [6]. However, this application also does not have our topic filtering; instead, it has keyword filtering like Tweetlogix, which, therefore suffers the same consequences. It also does not provide a way for the users to track and manage their time on the app. Therefore, our app has relevance in the market compared with this app. more so, if we can overcome operating system limitations.

In conclusion, in this part, our extension does not have a competition that destroys its feasibility for users compared with similar extensions.

3.2. Academic Analysis

In the research done on social media usage patterns, it is shown that Twitter has increasing popularity in many countries and is a very relevant social media platform[7]. Therefore, from the increasing consumption, the usage of the app is high and relevant enough to do a project about it.

In research done on limiting social media consumption, there were conclusions that can be made in favor of the time spent on social media as well as the ones that are against it. Therefore, the user tracking their habits and usage individually is the most reasonable option in this matter[8]. This shows that regulating the user's habits is best done by their own needs. An app like ours guides users in learning their own habits, like time spent on the app, which subjects are on their feed, and how to regulate it.

It is shown through research that social media addiction and consumption are concerning, and as a solution to this, the strategies to reduce social media consumption include limiting screen time, creating boundaries on the usage time of social media, being aware of the problems that social media usage brings and using apps to track time and help regulate habits of the user [8]. These issues can be applied on Twitter as it is a relevant and popular social media platform, and this shows the real-world necessity of our project. Because we create an extension that can limit user's spent time on the app and create boundaries in what subject they would like to research and how much time they like to spend, our extension is very much necessary for users that want to regulate their time on social media and not fall into a social media addiction problem.

Our extension can also be used by people who are busy and do not have much time to spend on the app and wants to look at just specific kind of posts. As Twitter is shown in research that it appeals to a more mature type of audience in the age range than some other apps, it would not be a stretch to assume a lot of its audience is people with jobs or people who are in higher education levels which would need this kind of regulation[9].

5. Glossary

ML: Machine Learning
AI: Artificial Intelligence

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