**VISVESVARAYA TECHNOLOGICAL UNIVERSITY**

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**Project Report**

**On**

**"Web Vibe & Comment Sentinel: A Smart Chrome Extension for Real-Time Sentiment Detection Across Social Platforms"**

***In the partial fulfilment of the requirement for the award of degree***

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***Submitted by***

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**ABSTRACT**

This Chrome extension provides real-time sentiment analysis of comments on websites. It uses a Support Vector Machine (SVM) model with about 90% accuracy to sort comments into positive and negative categories, ignoring irrelevant HTML content. A pop-up displays the sentiment results, highlighting negative comments for easy identification. Future updates plan to incorporate BERT for better detection of sarcasm and slang. The tool allows users to adjust sensitivity and select preferred websites. Feedback from users helps improve its performance. The goal is to create a smarter, more accurate tool for analyzing online sentiment. It aims to promote a friendlier online environment. The extension is simple to use and customizable. Ultimately, it strives to enhance the online user experience through smarter sentiment analysis

**CHAPTER 1**

**INTRODUCTION**

In the modern digital age, social media platforms such as Facebook, Instagram, Twitter, YouTube, and LinkedIn have become major spaces for public expression, where users frequently share thoughts, emotions, and opinions. The massive volume of textual interactions generated daily contains rich emotional information that, if analyzed properly, can offer valuable insights. As social media continues to shape public discourse, the ability to detect and understand sentiment in real time has become increasingly important for individuals, organizations, and digital communities.

Recent advancements in machine learning (ML), particularly with models like BERT and GPT, have significantly improved the accuracy and depth of sentiment analysis [7]. These models are capable of recognizing subtle emotional cues in text, even when expressed informally or in fragmented social media language.

The project "Web Vibe & Comment Sentinel" takes advantage of these technological advances by embedding ML-driven sentiment detection directly within a Chrome extension. Machine learning models are used to dynamically analyze and classify user-generated content on social media platforms into categories such as positive, negative, or neutral sentiments [7]. By operating in real time, this extension provides users with immediate emotional context while browsing social media, promoting safer, more informed, and emotionally aware online interactions [6].

* 1. **Aim of the project**

To develop a smart Chrome extension that utilizes machine learning models to detect and classify user sentiments in real time across various social media platforms like Facebook, Twitter, Instagram, LinkedIn, and YouTube.

**1.2 Motivation**

The widespread use of social media has led to an influx of diverse opinions and emotional expressions, but it has also increased the spread of negativity, misinformation, and emotional volatility [2]. Although platforms provide basic content moderation, there is still a gap in offering personalized real-time emotional insights. Inspired by recent advances in machine learning and sentiment analytics [3][7], this project seeks to empower users by providing instant emotional context as they navigate social media platforms, encouraging healthier and more emotionally aware interactions [6].

**1.3 The Problem Statement**

Existing sentiment analysis solutions are often platform-specific, lack real-time capabilities, or require external applications for analysis. Furthermore, they may not offer immediate emotional feedback while the user is actively browsing social media. There is a growing need for a lightweight, browser-based solution that uses machine learning to classify sentiments in real time across multiple platforms like Facebook, Instagram, Twitter, LinkedIn, and YouTube [4][6][7].

**1.4 Scope of the project**

* **Target Platforms**: Facebook, Instagram, Twitter, LinkedIn, and YouTube.
* **Sentiment Detection**: Categorizing user content into positive, negative, and neutral emotions.
* **Technology Stack**: Chrome Extension APIs, JavaScript for frontend operations, Python-based machine learning backend, leveraging TensorFlow or Hugging Face models [7].
* **User Interface**: Real-time pop-up notifications or dashboards summarizing sentiment analysis.
* **Performance**: Lightweight model integration to ensure fast response without affecting browser speed.
* **Limitations**: Dependent on publicly accessible comment data; real-time performance may vary based on internet speed and platform APIs.

**1.5 Objectives**

* To design a Chrome extension capable of dynamically extracting user comments and posts during live browsing.
* To implement advanced machine learning models such as BERT or GPT to accurately detect sentiments.
* To classify extracted text into sentiment categories: positive, negative, and neutral.
* To deliver real-time sentiment feedback directly on the user interface without disrupting the browsing experience.
* To ensure smooth functioning across multiple platforms including Facebook, Instagram, Twitter, LinkedIn, and YouTube.
* To maintain data privacy and minimize processing delays for an optimal user experience.

**CHAPTER 2**

**LITERATURE SURVEY**

1. A Study on Social Media Sentimental Analysis in Hindi Language​

* This study focuses on analyzing sentiments in Hindi social media posts, mainly on Twitter. Machine learning models are used to classify tweets as racist, sexist, or normal. It highlights how sentiment analysis is important for identifying hate speech online.
* Future work can apply deep learning models (like BERT for Hindi) to better detect sarcasm, code-mixed Hindi-English comments, and handle larger datasets.

2. Social Media Censoring Using Visual Sentimental Analyzer​

* This project proposes real-time image sentiment analysis using Inception V3 to filter out offensive images before they are posted. The model helps improve content moderation by detecting visual vulgarity.
* A future upgrade could involve combining text analysis with image analysis, allowing the platform to catch both bad images and abusive captions at once for complete content control.

3. Sentiment and Tone Analysis of Reddit Posts Using Python​

* This work analyzed Reddit posts' sentiment (positive, negative, neutral) and tone (formal or informal) using Python libraries like VADER and TextBlob. It helped in understanding public opinions and communication styles.
* In the future, advanced transformer models like BERT or RoBERTa can be used to better handle sarcasm, informal language, and emoji-rich text commonly found on Reddit.

4. Sentiment Analysis and Likes Prediction from Social Media Comments: An ML Approach​

* This project predicts comment sentiment (positive, neutral, negative) and likes prediction using various machine learning models such as Logistic Regression and HistGradient Boosting. It focuses on understanding audience reactions better.
* Future improvements can include adding metadata like post time, user influence score, and hashtag analysis to improve the accuracy of likes prediction and emotion classification.

5. End-to-End Comments Filtering Feature Using Sentiment Analysis​

* A multilingual system was developed using LSTM and Naive Bayes models to filter and delete negative comments on social media, especially supporting Tamil, Tanglish, and English languages.
* A future step would be to integrate reinforcement learning, allowing the system to learn and adapt to new types of abusive comments over time without manual retraining.

6. Explainable Dual-Branch Combination Network for Sentimental Analytics of Social Media Short Comments

* The authors proposed an explainable AI model (DCN) that not only predicts sentiment but also explains which words and sentence parts were important for the decision. It uses SHAP values and position attention mechanisms.
* Future work could focus on reducing model complexity to allow this explainable system to be used in real-time mobile or embedded environments, making it faster and lighter.

7. Transforming Sentimental Analysis Applying Deep Learning with BERT and GPT for X Data Insights​

* This paper compared BERT and GPT models for sentiment analysis on Twitter (X). Both models captured context and hidden emotions better than traditional methods, but required lots of data and computing resources.
* Future research can explore fine-tuning smaller transformer models (like DistilBERT) to maintain good accuracy while reducing training time and computational costs, making models accessible for smaller organizations.

**CHAPTER 3**

**PROBLEM DEFINATION**

Existing sentiment analysis solutions are often platform-specific, lack real-time capabilities, or require external applications for analysis. Furthermore, they may not offer immediate emotional feedback while the user is actively browsing social media. There is a growing need for a lightweight, browser-based solution that uses machine learning to classify sentiments in real time across multiple platforms like Facebook, Instagram, Twitter, LinkedIn, and YouTube [4][6][7].

**3.1 Existing System**

Various existing systems have explored sentiment analysis across multiple languages, media types, and platforms using diverse machine learning techniques. Some systems classify Hindi tweets into categories such as racist, sexist, or normal, leveraging traditional machine learning models for text classification. Other approaches focus on analyzing images in real time for offensive content detection using deep learning architectures like Inception V3, thus extending sentiment analysis beyond text to visual content. In the domain of social media, Reddit posts have been analyzed using lightweight sentiment libraries like VADER and TextBlob to determine not only the polarity (positive, negative, neutral) but also the tone (formal, informal) of the discussions. Some models predict both the sentiment of user comments and the expected number of likes using Logistic Regression and HistGradient Boosting techniques. Furthermore, multilingual sentiment analysis systems have been developed that filter out negative comments written in Tamil, Tanglish, and English using LSTM networks combined with Naive Bayes models, thereby supporting diverse linguistic environments. Recent advancements have introduced explainable AI methods, such as Deep Contextualized Networks (DCN) and SHAP values, to highlight key text components responsible for a model's sentiment prediction, making the analysis more transparent and interpretable. Additionally, more sophisticated models like BERT and GPT are being employed to detect sentiments and hidden emotions within Twitter data, pushing the capabilities of sentiment analysis toward deeper emotional understanding and better accuracy across complex social media environments.

**Limitations of Existing System**

* Limited Multilingual Support: Most models focus on specific languages, limiting their ability to generalize to others.
* Real-Time Processing Challenges: Many models are too resource-intensive for real-time data processing.
* Contextual Misunderstanding: Difficulty in understanding sarcasm, humor, and complex expressions in user-generated content.
* Scalability Issues: Some models may not scale efficiently to handle large volumes of data.
* Inability to Detect Emerging Trends: Struggles with adapting to new slang, expressions, or evolving societal norms without continuous updates.

**3.2 Proposed System**

The proposed system enhances real-time sentiment detection across social platforms by integrating advanced and efficient models. For Hindi content, BERT-based models will improve sentiment accuracy, especially for sarcasm and code-mixed language. Multi-modal moderation will combine text and image analysis to detect offensive content more comprehensively. Transformer models like BERT and RoBERTa will handle informal language, emojis, and varying tones more effectively. To improve sentiment and engagement prediction, metadata such as user influence and hashtags will be considered. Adaptive filtering using reinforcement learning will enable the system to adjust to emerging abusive trends without manual retraining. Lightweight models like DistilBERT will be fine-tuned to balance high accuracy with lower computational cost, making the Chrome extension efficient for real-time use.

**CHAPTER 4**

**SYSTEM REQUIREMENT SPECIFICATION**

To support the proposed **Web Vibe & Comment Sentinel** Chrome extension effectively, the following hardware requirements are essential. These specifications ensure that the extension operates efficiently, securely, and reliably, while meeting the performance expectations for real-time sentiment detection across social media platforms.

* 1. **Hardware Specification**
* **Processor**: Intel Core i3 / AMD Ryzen 3 or higher
* **RAM**: 4GB or more
* **Keyboard**: USB/normal keyboard
* **Mouse**: Compatible USB or wireless mouse
* **Display**: Minimum 13-inch screen with 1366x768 resolution
  1. **Software Specification**
* **Front-end**: HTML, CSS, JavaScript (for Chrome Extension interface)
* **Machine Learning**: TensorFlow.js / Hugging Face Transformers (for local sentiment analysis)
* **Browser**: Latest version of Google Chrome (supporting Manifest V3)
* **Code Editor**: Visual Studio Code (VS Code)
* **Notebook Environment**: Jupyter Notebook (for model development, training, and offline sentiment analysis)
* **Extension APIs**: Chrome Extensions API (Manifest V3 standard)

**4.3 Functionality Requirements**

1. Real-Time Sentiment Analysis:

* Allow the Chrome extension to automatically fetch and process social media comments (not posts) in real time.
* Analyze extracted comment text using embedded machine learning models (like BERT or GPT) to detect and classify sentiments as positive, negative, or neutral [7].

2. User Interface:

* + - Provide a lightweight, browser-based popup UI using HTML, CSS, and JavaScript for displaying real-time sentiment results.
    - Ensure intuitive navigation for users to view the sentiment of individual comments or overall comment sentiment distribution.

3. Data Privacy and Local Processing:

* + - Perform sentiment analysis locally within the user's browser to protect user data privacy.
    - Avoid external storage or transmission of fetched comments unless explicitly permitted by the user.

4. Cross-Platform Support:

* + - * Ensure compatibility for fetching and analyzing comments from major platforms like Facebook, Instagram, Twitter, LinkedIn, and YouTube.
      * Support detection of dynamically loaded comment sections (infinite scroll, load-more features).

5. Model Management and Updates:

* + - * Allow seamless updates to the embedded machine learning models to improve sentiment classification performance.
      * Ensure users can receive model updates without needing to reinstall or manually update the extension.

6. Extension Management:

* + - * Enable installation, updating, enabling/disabling, and permission management through the Chrome Web Store interface.
      * Allow users to toggle sentiment analysis on specific websites if desired.
  1. **Non-Functional Requirements**

Performance:

* + - The extension should work efficiently, analyzing up to 50 comments per page without noticeable delays.
    - Operate smoothly on standard devices with 4GB RAM and basic CPU specifications.

2. Reliability:

* + - Maintain consistent sentiment detection across various comment layouts and website designs.
    - Handle cases where comments may be missing, duplicated, or dynamically loaded without failure.

3. Usability:

* + - Interface must be intuitive and minimalistic, requiring no specialized knowledge for users to understand sentiment results.
    - Display sentiment using simple visual cues (e.g., colored tags, emoticons).

4. Scalability:

* + - Allow easy future expansion to support more platforms or additional comment features.
    - Ensure modular coding practices to add new ML models or techniques without major rework.

5. Security:

* Analyze comments fully within the user’s local environment to maintain complete privacy.
* Protect against browser-based vulnerabilities such as cross-site scripting (XSS) attacks.

6. Maintainability:

* + - Code should be modular, clearly documented, and adaptable for future feature additions like multi-language sentiment detection.
    - Enable quick debugging and patching to ensure ongoing compatibility with social platform updates.

**CHAPTER 4**

# ****TECHNICAL FEASIBILITY****

The proposed system is technically feasible given the current advancements in browser extension development, machine learning model optimization, and web-based real-time data processing. Chrome’s Extension APIs, particularly under Manifest V3, provide robust capabilities to access and manipulate page content securely, making it possible to fetch, analyze, and display YouTube comments dynamically within the browser itself. Using lightweight yet powerful transformer models like DistilBERT and fine-tuned BERT variants allows real-time sentiment analysis without causing significant delays or memory overload, even on standard consumer hardware. These models can be integrated using TensorFlow.js or similar JavaScript-based machine learning libraries, eliminating the need for heavy server-side computation and ensuring data privacy since the analysis occurs locally within the user's device.

The system also leverages Jupyter Notebook during the development phase for training, evaluating, and fine-tuning the sentiment models before embedding them into the extension, ensuring high accuracy and optimized performance. The extension will incorporate reinforcement learning principles for adaptive comment filtering, making the tool capable of learning from new abusive patterns over time without requiring constant manual updates. Additionally, integrating Explainable AI components like SHAP values ensures that users can receive transparent insights into why specific sentiments were assigned, thereby enhancing trust and usability.

In terms of deployment, the use of HTML, CSS, and JavaScript ensures cross-platform compatibility and seamless integration with the Chrome browser ecosystem. Minimal hardware requirements (a device with at least 4GB RAM and a standard i3 processor) ensure that a wide range of users can use the extension without needing high-end computing resources. Finally, the modular development approach using Visual Studio Code will facilitate easy maintenance, future upgrades, and scalability, ensuring that the system remains adaptable to emerging needs and technologies.

**REFERENCES**

1. A. Sindhu, D. Jayakumar, S. Sasivardhini, M. O. Ramkumar and R. Rajmohan, "End To End Comments Filtering Feature Using Sentimental Analysis," 2024 Third International Conference on Smart Technologies and Systems for Next Generation Computing (ICSTSN), Villupuram, India, 2024, pp. 1-6, doi: 10.1109/ICSTSN61422.2024.10671080. keywords: {Sentiment analysis;Ethics; Filters;Video on demand;Social networking (online);User-generated content;Naive Bayes methods;Sentiment Analysis;Multilingual Text Processing; LSTM Networks; Naïve Bayes Classifier;Social Media;Comment Filtering;Tamil Language;Tanglish; English Language;Negative Comment Detection;Online Community Management; Automated Moderation},
2. S. Y, K. K, P. S and R. Ryan, "Social Media Censoring Using of Visual Sentimental Analyzer," 2024 3rd International Conference on Sentiment Analysis and Deep Learning (ICSADL), Bhimdatta, Nepal, 2024, pp. 1-7, doi: 10.1109/ICSADL61749.2024.00007. keywords: {Visualization;Sentiment analysis;Image recognition;Social networking (online);Transfer learning;Real-time systems;Web sites;Visual Sentiment Analyzer;Transfer learning;Inception v3;Image-classification},
3. M. R. Sree, M. Siddhartha, P. V. V. Reddy and M. Belwal, "Sentiment Analysis and Likes Prediction from Social Media Comments: An ML approach," 2024 15th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kamand, India, 2024, pp. 1-8, doi: 10.1109/ICCCNT61001.2024.10725921. keywords: {Sentiment analysis;Accuracy;Social networking (online);User-generated content;Static Var compensators;Oral communication;Predictive models;Boosting; Market research; Optimization;Sentiment Score;Lexical Analysis;Likes;Comments; Machine Learning; Sentiment Classification},
4. Amod Agarkar, S. Betgeri, A. Nimbalkar, V. Nikam, C. Rane and P. Motade, "Sentiment and Tone Analysis of Reddit Posts Using Python," 2025 4th International Conference on Sentiment Analysis and Deep Learning (ICSADL), Bhimdatta, Nepal, 2025, pp. 100-104, doi: 10.1109/ICSADL65848. 2025.10933201. keywords: {Sentiment analysis; Analyticalmodels;Vocabulary;Accuracy;Socialnetworking(online);Scalability; Noise; Planning;Computational efficiency;Public policy;Reddit; Sentimental Analysis; Natural Language Processing;Tone Detection;VADER;TextBlob},
5. P. Yadav, R. Kaur and A. Kumar, "A Study on Social Media Sentimental Analysis in Hindi Language," 2023 International Conference on Circuit Power and Computing Technologies (ICCPCT), Kollam, India, 2023, pp. 1395-1400, doi: 10.1109/ICCPCT58313.2023. 10244998. keywords: {Support vector machines; Training;Sentiment analysis;Analytical models;Social networking (online) ;Computational modeling;Blogs;NLP;NLTK;racism; sentimental;twitter;text mining},
6. Z. Wang, P. Wang, L. Qi, Z. Sun and X. Zhou, "Explainable Dual-Branch Combination Network With Key Words Embedding and Position Attention for Sentimental Analytics of Social Media Short Comments," in IEEE Transactions on Computational Social Systems, doi: 10.1109/TCSS.2025.3532984. keywords: {Feature extraction;Analytical models;Social networking (online);Emojis;Computational modeling;Media;Support vector machines; Encoding;Accuracy;Vectors;Energy consumption predict;energy-efficient scheduling; machine learning},
7. M. S. Varma and S. Ghosh, "Transforming Sentimental Analysis: Applying Deep Learning with BERT and GPT for X Data Insights," 2025 International Conference on Visual Analytics and Data Visualization (ICVADV), Tirunelveli, India, 2025, pp. 561-566, doi: 10.1109/ICVADV63329.2025.10961289. keywords: {Deep learning; Sentiment analysis;Analytical models;Accuracy;Social networking (online);Generative Pre-trainer transformer;Bidirectional control;Transformers; Encoding;Data models; Twitter;BERT; GPT;Transformers;Deep Learning},