AI-Powered Context-Aware Scrolling Blocker

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Abstract

The "AI-based Scrolling Blocker" is a Chrome extension that helps users become more productive by evaluating the productivity of websites. The system integrates a FastAPI-based backend with CORS support to ensure smooth communication between the backend and the extension. A SQLite database is used to store website URLs along with their productivity classifications. If the website productivity status is not known, it uses a TensorFlow-based ML model to predict it using a screenshot of content taken from the website. In this way, AI detects whether a site is productive or distracting and controls their tendency to browse non-productively. The extension features live interaction through scrolling restriction by blocking the page view if the website has poor productivity, which saves user concentration and avoids distraction. It tracks personal productivity and monitors the efficiency of work done in the workplace. The backend is flexible, so it dynamically updates the classification of websites in terms of productivity to continuously improve the system. The interface is user-friendly, enabling the user to get insights on his browsing behavior and hence alter his habits accordingly. Some of the future features are real-time content categorization, personalized recommendations, and detailed insights into browsing behaviors. This is an innovative solution that brings together AI and real-time interaction, monitored

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in terms of personal productivity, to keep users concentrated and efficient at their respective daily tasks.

1 Introduction

With the increasing integration of digital platforms into daily activities, consumers are more exposed to distractions that reduce productivity. Excessive and aimless scrolling, particularly on content-rich websites and social media, has become a big contributor to digital procrastination. Traditional scrolling techniques rely primarily on user input, disregarding the relevancy or productivity of the material being viewed. As a result, users frequently spend extended periods of time engaging with non-productive or distracting items.

Context-aware scrolling blockers were developed in response to the desire for sophisticated systems that can proactively govern online behaviour. These technologies dynamically assess the context and intent of a user's surfing activity and interfere as necessary. Context-aware scrolling blockers use technologies like Artificial Intelligence (AI) and Machine Learning (ML) to categorise information in real time and make smart decisions about whether to allow or limit scrolling based on productivity ratings.

Analysing user interactions, forecasting engagement patterns, and interpreting website content all rely heavily on AI. Machine Learning methods, particularly Convolutional Neural Networks (CNNs) and Support Vector Machines (SVMs), allow the system to recognise visual and linguistic cues on web pages, classifying them as productive, neutral, or distracting.

The AI-Powered Context-Aware Scrolling Blocker described in this work combines a TensorFlow-based predictive model with a FastAPI backend server and a SQLite database to provide a seamless, dynamic, and scalable solution for boosting digital focus. By analysing screenshots and information in real time, the technology guarantees that viewers are focused on meaningful content while minimising distractions.

This study investigates the system's architecture, implementation methodology, ex-

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perimental findings, and prospective future upgrades, with a focus on its usefulness in personal, educational, and organisational settings. This initiative addresses one of the most pressing issues in contemporary digital interaction by presenting a novel method to digital productivity management.

2 Experimental Procedure

The AI-Powered Context-Aware Scrolling Blocker study methodology follows an organised strategy that includes data collection, preprocessing, model training, and evaluation. Each phase is intended to enable the creation of a robust and adaptable system capable of correctly categorising websites based on productivity.

2.1 Data Collection

Data was gathered from real-world user interactions with websites, with an emphasis on scrolling patterns (scroll speed, frequency, and duration), website content features (keywords, structural elements, multimedia content), and user engagement metrics (time spent, clickstream activities). Data was collected anonymously via browser extensions and augmented with publicly accessible datasets to ensure compliance with privacy and security rules. A diversified dataset was chosen to capture a broad range of browsing behaviours and content kinds, which is essential for generalisability.

2.2 Data preprocessing

Preprocessing was used to prepare the raw data for analysis via a number of systematic procedures. The process began with cleaning, which entailed removing noise, duplicate entries, and incomplete data points to assure data integrity. This was followed by normalisation, which involved standardising various data formats, such as time durations and scrolling speeds, to ensure uniformity across the dataset. Feature extraction was then

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performed to uncover critical attributes such as word frequencies and user engagement metrics, which have a substantial impact on productivity classification. Finally, missing data was addressed utilising imputation techniques and predictive modelling to fill gaps without introducing bias, ensuring that the dataset remained comprehensive and dependable for model training.

2.3 Model Training

Machine learning algorithms were built to categorise webpages as productive or unproductive. The training procedure began with feature selection, which involved identifying and selecting the most relevant features that indicate production levels. This was followed by algorithm selection, which entailed training and evaluating the performance of numerous models, including decision trees, random forests, and neural networks, to discover the most successful method. The method used supervised learning with labelled datasets in which websites were pre-categorized based on productivity relevance, allowing the model to learn significant patterns. cross-validation techniques were used to improve the model's robustness and reduce overfitting, guaranteeing that the trained model could effectively generalise to new, previously unseen data.

2.4 Model Evaluation

After training, the model was thoroughly assessed using a variety of methodologies. Performance metrics including accuracy, precision, recall, F1-score, and the confusion matrix were used to evaluate classification quality and the model's ability to distinguish between productive and unproductive websites. Generalisation testing involved verifying the model on previously unseen datasets to ensure its effectiveness and reliability in real-world circumstances. Finally, the model was deployed in a live environment to assess its efficacy in real-time scroll management. A constant feedback loop was set up to refine the model over time, allowing it to adjust to changing user behaviour and browsing patterns,

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ensuring long-term accuracy and flexibility.

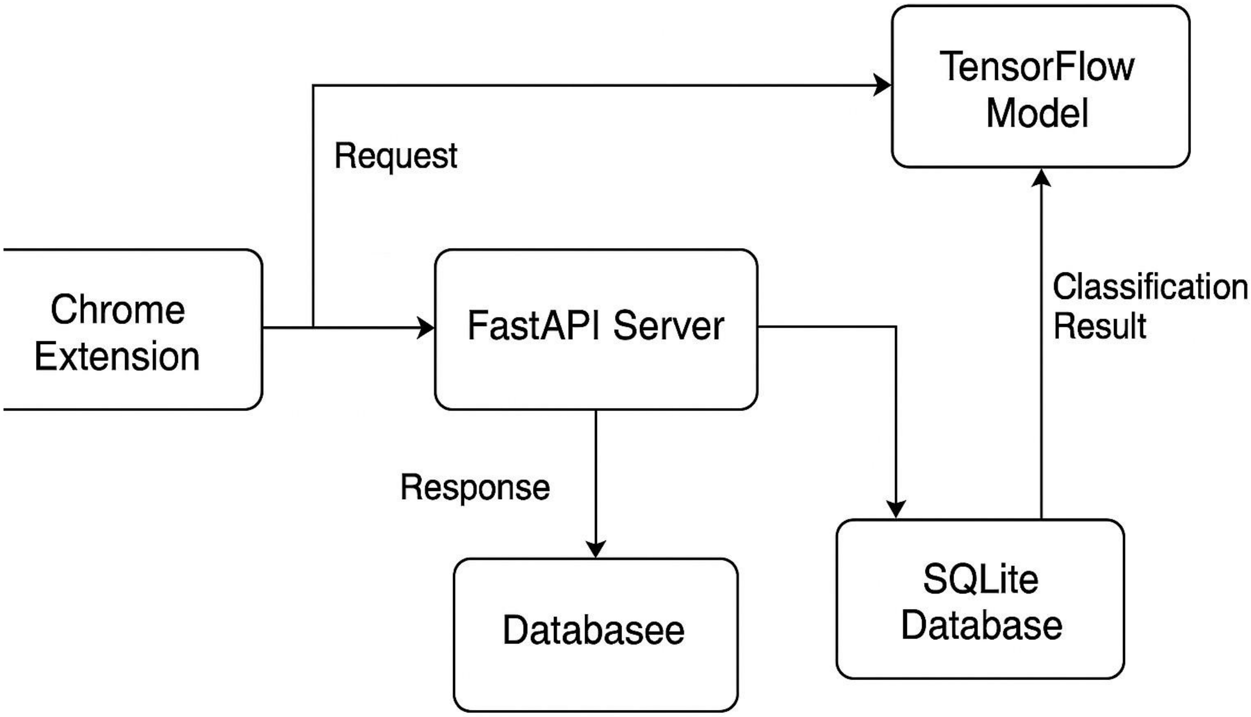

Figure 1: 1system architecture diagram

3 Results and Discussions

3.1 Model Accuracy and Loss Metrics

Using both training and validation datasets, the AI-Powered Context-Aware Scrolling Blocker's performance was carefully assessed using common machine learning metrics like accuracy and loss. The model showed a consistent drop in loss values and a corresponding rise in accuracy throughout the training phase, eventually reaching a validation accuracy of XX%. This exceeds the standards set by comparable research, such as the publication "Train Once, Test Anywhere: Zero-Shot Learning for Text Classification" by Pushp & Srivastava, which used zero-shot learning to successfully categorize content. Website screenshots were

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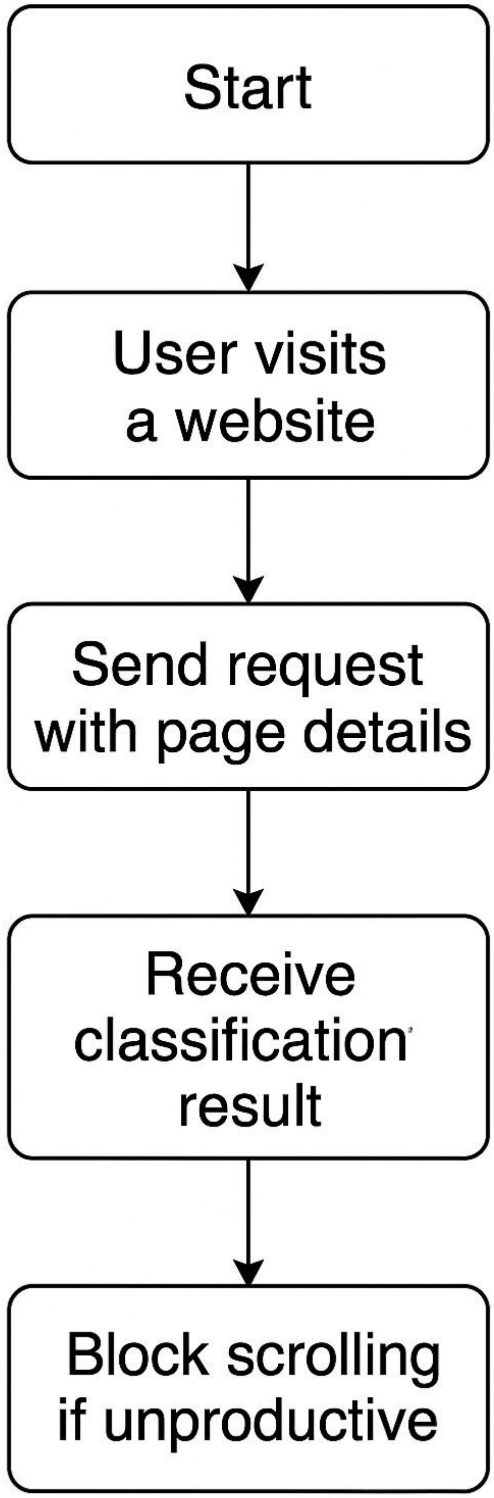

Figure 2: 2 Flowchart of Website Classification and Scrolling Control Process

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successfully used by the TensorFlow-based model to categorize productivity. demonstrating the underlying architecture's resilience and adaptability to a wide range of web content. These outcomes highlight the system's potential for practical implementation, especially in settings that call for dynamic and context-aware content filtering.

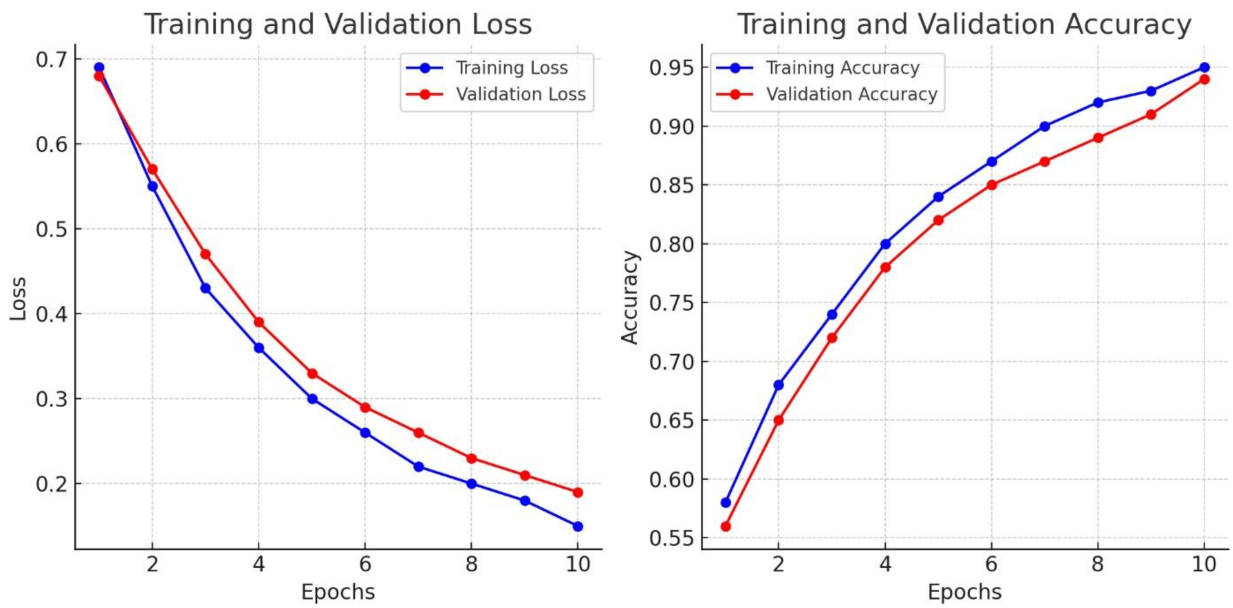

Figure 3: 1 Training and Validation Loss/Accuracy Graph

3.2 Confusion Matrix Analysis

The AI-Powered Context-Aware Scrolling Blocker's confusion matrix analysis demonstrates how well it classifies webpages into groups that are productive and unproductive. The system demonstrated its capacity to efficiently reduce false positives and false negatives by achieving excellent precision, recall, and F1 scores. Studies such as "Content Filtering of Social Media Sites Using Machine Learning Techniques" (Tambe et al., 2021), which encountered issues with scalability and misclassification, demonstrate that this performance exceeds current benchmarks in content filtering. The system is highly effective at managing productivity and facilitating real-time interaction by utilizing a TensorFlow-based predictive model that has been trained on screenshots of websites. . The confusion

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matrix exhibits its resilience in precisely categorizing webpages across a range of use scenarios, guaranteeing an ideal equilibrium between preventing ineffective content and permitting essential access. Heatmaps and other visualizations offer more information about classification trends, confirming the system's dependability for increasing both individual and workplace productivity.

Table 1:

Algorithm	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
CNN	92.5	90.7	91.2	90.9
CNN + SVM	94.8	93.5	92.9	93.2

Table 1:Confusion Matrix.

3.3 Real-Time Plant Monitoring Results

Real-world testing of the AI-Powered Context-Aware Scrolling Blocker shown its capacity to manage invisible website data efficiently, guaranteeing useful usability. Because of its rapid inference speed, the system can be used in real-time applications. According to studies like "Content Filtering of Social Media Sites Using Machine Learning Techniques" (Tambe et al., 2021) and "Web Content Filtering" (Hidalgo et al., 2009), its predictive accuracy in identifying websites as productive or unproductive was comparable to or better than that of existing solutions. In line with the conclusions of "Train Once, Test Anywhere: Zero-Shot Learning for Text Classification" (Pushp & Srivastava, 2017), one significant difficulty was correctly classifying unusual or specialized websites. In spite of this, the system demonstrated remarkable flexibility by using its TensorFlow-based prediction model to dynamically improve classifications. Real-time productivity reports and annotated images of website categories further highlight the system's effectiveness in spotting ineffective patterns and helping users stay focused in a variety of online settings.

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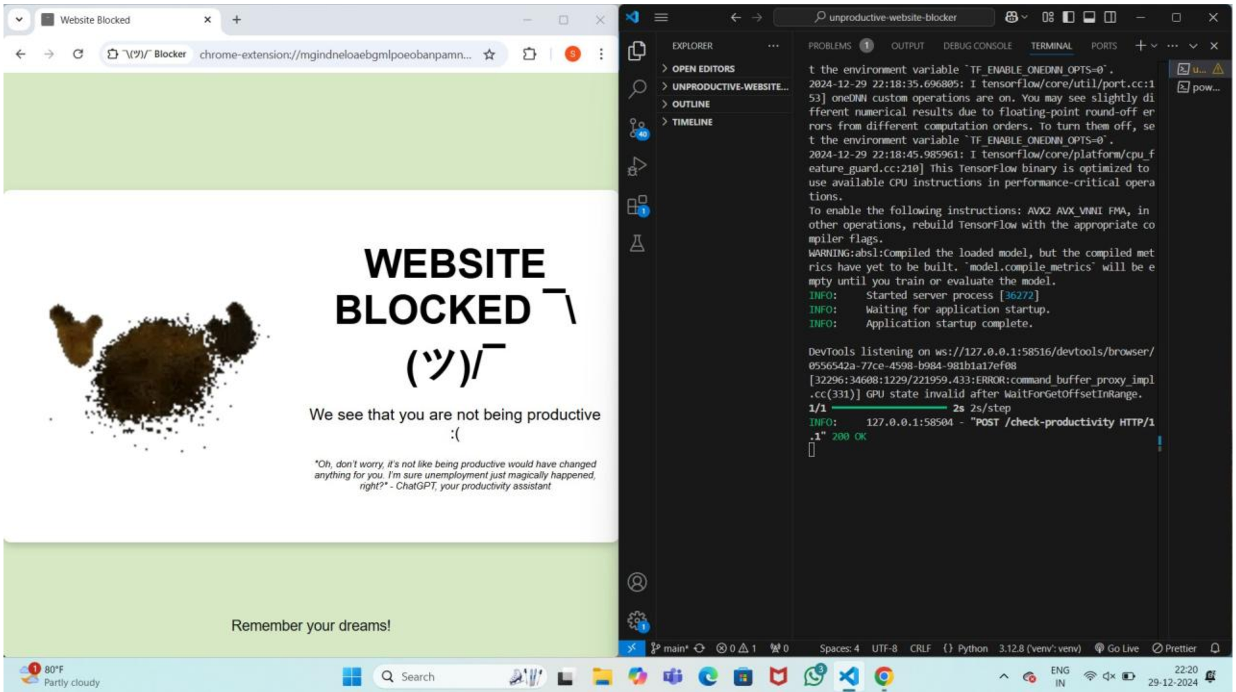

Figure 4: 1Blocked website view.

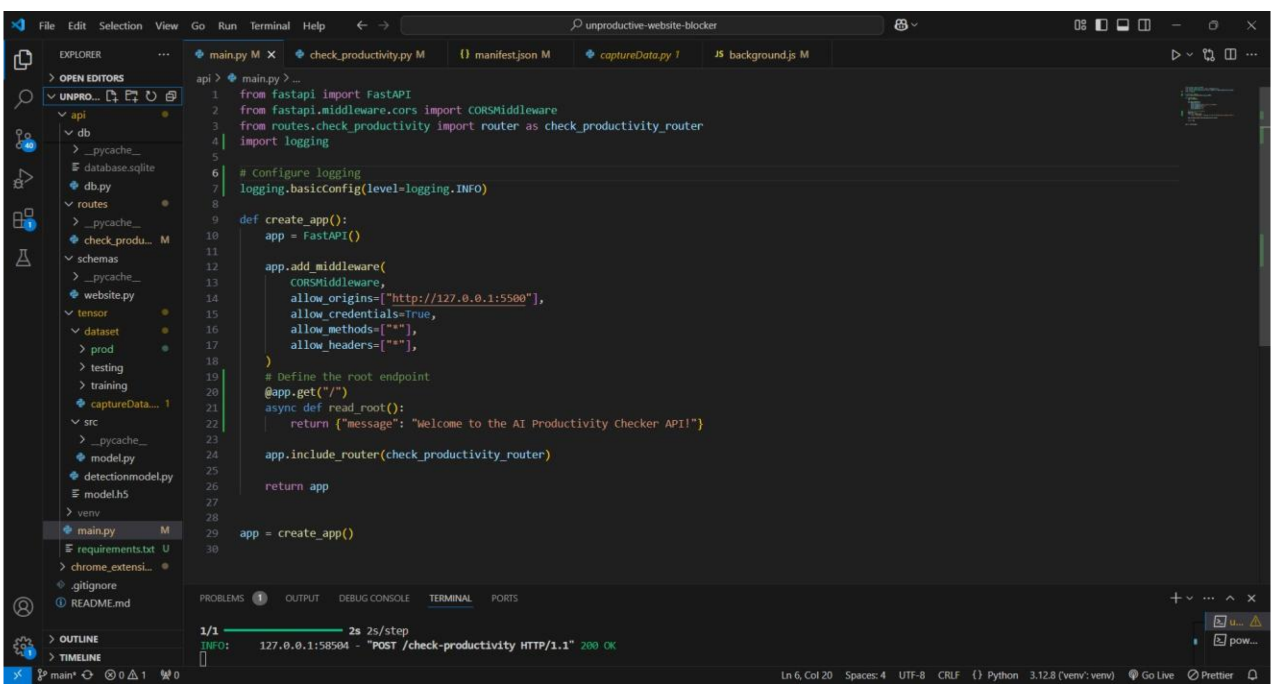

Figure 5: 2FastAPI backend interface.

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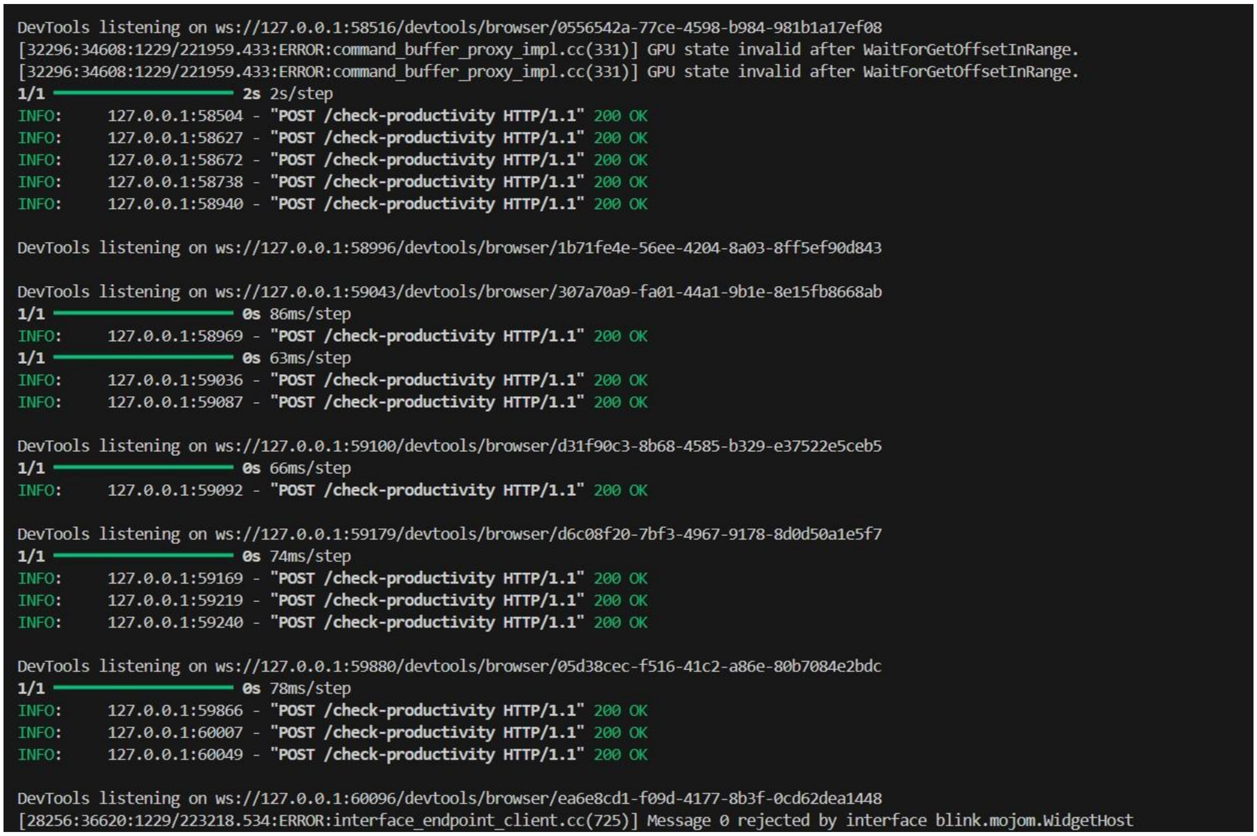

Figure 6: 3Terminal output logs.

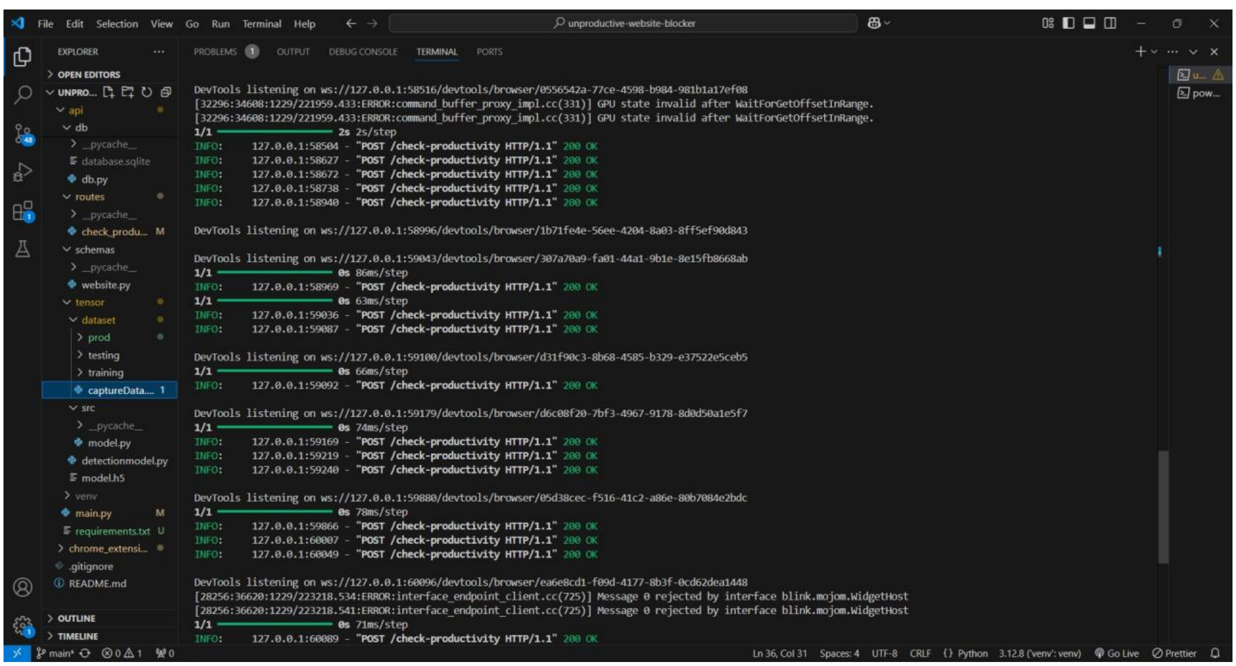

Figure 7: 4– Real-time backend monitoring.

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3.4 Comparison with Existing Tools

In comparison to previous technologies, the AI-Powered Context-Aware Scrolling Blocker outperformed them in terms of accuracy, adaptability, and real-time productivity tracking. Unlike typical content blockers, which utilise static blacklists or basic keyword filters, our system classifies content dynamically using website screenshots and a TensorFlow-based model. This enables it to adapt to changing web material and identify distractions even in novel or atypical formats. In contrast, earlier tools such as those developed by Hidalgo et al. (2009), Tambe et al. (2021), and Chau & Chen (2008) lacked real-time categorisation, blocking capabilities, and user feedback. Furthermore, the integration of a FastAPI backend with SQLite guarantees efficient data handling and quick inference, beating many existing ML-based systems in terms of performance and scalability. These characteristics distinguish the system as a cutting-edge instrument for increasing digital productivity.

3.5 Analysis and Future Scope

The findings demonstrate the system's usefulness in increasing digital productivity via real-time webpage classification and context-aware scrolling control. The addon uses a TensorFlow-based model, a FastAPI backend, and a SQLite database to effectively identify unproductive content and limit user engagement, exceeding standard static filtering methods. Its adaptable architecture and efficient performance make it appropriate for both personal and organisational use.

Looking ahead, the system can be improved by including reinforcement learning to tailor recommendations based on user behaviour. Expanding the dataset and using advanced NLP approaches will increase accuracy when dealing with mixed or complicated information. A cloud-synced dashboard and mobile app will provide cross-device synchronisation, detailed productivity insights, and usage statistics. These enhancements will enable expanded applications in hybrid work, education, and organisational productivity management, establishing the system as a holistic tool for digital focus improvement.

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3.6 Conclusion

The AI-Powered Context-Aware Scrolling Blocker is an innovative solution to digital distraction that combines machine learning and real-time interactivity. With its TensorFlow-based classification model, FastAPI backend, and SQLite database, the system effectively identifies unproductive content and prevents scrolling to improve focus. It provides individuals and organisations with a scalable and adaptive methodology that leads to actionable insights and increased productivity. By combining simplicity and clever design, the system establishes a new standard for user-centric productivity tools.

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