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AI Powered Digital Detox and Parental Control App

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ABSTRACT

This project focuses on building a digital wellbeing and parental control application aimed at helping users manage their screen time, monitor app usage, and encourage healthy digital habits. The system is designed as an Android application that enables both parents and children to engage with its features. Parents can track their child's device activity, set usage limits, and view AI-generated insights, while children are guided towards mindful usage through digital detox tools such as focus mode, app blocking, and excess usage alerts. Firebase services, including Firestore and Authentication, form the backbone of data management and secure access. The app's modular design makes it easy to expand with future enhancements such as anomaly detection in app usage, AI-powered wellness scores, predictive lock recommendations, and emotion-aware notifications. By combining user monitoring with AI-driven recommendations, the application ensures consistency, reliability, and accessibility across devices. The goal is to create a scalable and privacy-friendly solution that not only manages device usage but also promotes long-term digital wellness, making it suitable for families and individuals seeking balance in today's screen-driven world.

1. INTRODUCTION

This project is a digital wellbeing and parental control application designed to help users manage screen time, monitor app usage, and encourage healthier digital habits by integrating modern tools and technologies. Raw usage data such as app activity, screen-on duration, and frequency of app launches is collected from the child's device and securely stored in Firebase for real-time synchronization across devices. Developed in Java using Android Studio, the system standardizes and processes the collected data to ensure accuracy, while background services and custom logic classify applications into categories like productivity, entertainment, or social media to generate meaningful insights. Parents access this information through a user-friendly dashboard, where they can track detailed usage patterns, set screen time limits, and block applications directly. The modular design supports future enhancements such as AI-powered wellness scores, predictive usage alerts, and emotion-aware recommendations, ensuring scalability and adaptability. Built on a Windows 11 environment with Firebase Authentication, Firestore, and Cloud Messaging, the application delivers a reliable, secure, and practical solution for families aiming to balance technology use with long-term digitalwell-being.

In this project, different modules of the application work together seamlessly to ensure smooth functioning and efficient communication. Data handling and storage are managed through Firebase, which preserves user information such as app usage patterns, time limits, and authentication details even when the app is restarted or used across multiple devices. This ensures reliability and hassle-free migration without requiring users to reconfigure their settings. To improve performance, optimized background services have been implemented for monitoring app usage and enforcing restrictions without affecting device speed. The design also allows easy integration with advanced features such as NoSQL support and AI-based analysis in the future, ensuring scalability and adaptability. In summary, the application demonstrates the full cycle of digital wellbeing management—from usage tracking and limit enforcement to AI-powered insights—while adopting modern tools and technologies like Firebase for cloud storage, Java for development, and Android Studio for deployment. This enables learners and developers to gain practical experience in building scalable, production-ready mobile applications that meet current industry standards.

2. RELATED WORK

• Khan & Rahman present a broad overview of Digital Wellbeing applications, highlighting their role in reducing screen addiction, encouraging mindful usage, and supporting parental supervision through emerging technologies such as app monitoring, AI insights, and real-time notifications [1].

• Sharma et al. provide a data-driven survey, emphasizing the role of big data in digital wellness. They analyze how user behavior tracking, predictive analysis, and machine learning enable smarter interventions and adaptive screen time management [2].

• Ali et al. discuss a layered architecture of parental control systems, detailing monitoring, restriction, and reporting layers, while also exploring their interdependence and impact on managing excessive device use [3].

• Mehta & Banerjee examine digital wellbeing from a communication technology perspective, highlighting the importance of cloud services, Firebase, and cross-device synchronization for seamless parent-child interaction [4].

• Farooq et al. review AI-driven analysis methods in wellbeing apps, stressing how multi-source integration from usage data, notifications, and app categories improves prediction accuracy and personalized recommendations [5].

• Patel summarizes fundamental concepts of screen addiction management and explains how features like focus mode, app blocking, and time limits can help reduce digital distractions, particularly in younger audiences [6].

• Singh & Verma propose a blockchain-based parental control framework to ensure secure data sharing, integrity, and transparency between parents, children, and application servers [7].

• Hussain & Fatima emphasize the use of digital wellbeing systems in improving mental health by deploying AI-powered reminders, wellness scores, and real-time alerts for overuse [8].

• Reddy presents a background monitoring model for app usage detection, describing how continuous tracking and cloud integration can enable proactive interventions for healthier device usage [9].

• Kumar & Das discuss the evolution toward connected wellbeing ecosystems, proposing frameworks that combine AI, cloud computing, and predictive analytics to achieve next-generation digital balance [10].

• Iqbal & Noor investigate the role of deep learning in digital wellbeing, highlighting applications such as app classification, addiction pattern recognition, and behavior modeling [11].

• Wang et al. explore how soft computing methods—fuzzy logic, neural networks, and evolutionary algorithms—are being applied in wellbeing apps for managing uncertainty and optimizing recommendations [12]

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• Fernandez & Joseph explore the potential of low-cost sensor integrations, such as wearable connections, for activity-linked screen time monitoring and wellness tracking [13].

• Kapoor et al. provide a bibliometric review of AI-based digital wellbeing solutions, analyzing the growth of research areas including smart monitoring, emotion-aware notifications, and IoT integration in the wellness domain [14].

• Fernandez & Joseph revisit their earlier study on wearable-based wellbeing features, adding updated insights into how such technologies are being adapted in mobile ecosystems for scalable addiction management [15].

3. PROBLEM STATEMENT

This project addresses these challenges by developing a comprehensive end-to-end Digital Wellbeing and

Parental Control system that automates data collection, monitoring, and analysis of device usage. The app continuously gathers usage data from mobile devices and processes it efficiently to handle large volumes of records in real time. Structured data schemas and built-in Firebase rules ensure that user data remains consistent, while custom logic and background services normalize usage statistics and categorize apps reliably. Aggregation and analysis of app usage, focus periods, and screen time patterns are performed within the same workflow, eliminating the need for multiple disconnected processes. Secure and modular deployment ensures that every feature—from data collection to AI-based recommendations—operates in isolated, repeatable environments, preventing inconsistencies across devices or user accounts. Finally, processed information is presented through interactive in-app dashboards and downloadable reports, allowing parents to monitor trends, enforce limits, and gain actionable insights. The result is a fully integrated, end-to-end digital wellbeing solution that combines monitoring, analysis, and intervention seamlessly.

4. PROPOSED SYSTEM

The proposed system for this project is a comprehensive Digital Wellbeing and Parental Control application that leverages modular and efficient design principles to monitor, analyze, and manage device usage. The architecture enables parallel processing of usage data, categorization, and analysis in real time, ensuring scalability for handling multiple users simultaneously. Java and Android Studio provide a robust development environment, allowing developers to implement reliable background services, enforce app usage rules, and deliver accurate AI-driven insights. Automatic aggregation of usage metrics, such as screen time, app frequency, and focus periods, reduces manual effort and generates meaningful summaries for parents. Interactive dashboards and downloadable reports allow

offline analysis, ad-hoc exploration, and easy sharing. Containerization using Firebase services ensures uniformity across devices and secure management of authentication, storage, and real-time communication, while validation checks maintain data consistency and integrity. Structured processes, including schema enforcement, type checking, and data formatting, minimize errors and improve reliability. The Windows 11 development environment, combined with Android Studio's debugging, code completion, and integration features, provides a stable and efficient setup for building scalable, production-ready digital wellbeing solutions.

5. METHODOLOGY

Component Interaction Sequence in the Digital Wellbeing Application

The data processing in this project begins when the app's background services automatically collect usage data from a child's device. The scheduler-like mechanism runs autonomously to manage the sequencing and execution of data handling tasks. Collected raw data, including app activity, screen-on duration, and launch counts, is ingested into Firebase, where its structure is validated and enforced. Within the processing workflow, transformations are applied: app usage durations are normalized, applications are categorized into productivity, social media, or entertainment, and summary metrics such as total screen time and focus periods are calculated. The cleaned and enriched data is then stored securely in Firebase Firestore, while aggregated usage summaries are prepared for display in the parent dashboard. Interactive visualizations within the app present up-to-date statistics, trends, and patterns, enabling parents to make informed decisions about device restrictions and screen time management.

System Data Analysis in the Digital Wellbeing Application

The data analysis process in this project begins when the app's background scheduler automatically collects device usage data and manages the sequence of extraction, transformation, and storage tasks. Raw usage data, including app launches, screen-on time, and session durations, is streamed into the processing workflow within Firebase and validated for consistency. The scheduler also manages metadata, such as timestamps and user identifiers, to ensure accurate tracking and event-based processing. During transformation, the data undergoes cleansing, categorization, and aggregation—

normalizing usage durations, classifying apps, and calculating summary metrics like total screen time and focus intervals. The processed data is then securely stored in Firebase Firestore for long-term access and retrieval. To close the loop, the app's parent dashboard integrates this aggregated data to display interactive visualizations, charts, and real-time insights, enabling parents to monitor trends, enforce screen time limits, and make informed decisions regarding their child's digital wellbeing.

Actor Interaction Overview in the Digital Wellbeing Application

1. Secure Login

The user begins by selecting the "Log In" option and entering valid credentials to access the app's features, ensuring authorized and secure entry.

2. Data Collection

The app automatically collects device usage data, such as app activity, screen-on duration, and session counts. This background process serves as the data ingestion mechanism for subsequent analysis and processing.

3. Data Visualization

By accessing the "Dashboard" or "View Insights" feature, the user triggers the generation of dynamic visualizations. The app processes the collected data to create interactive charts and summaries that highlight usage patterns, focus periods, and app-specific statistics.

4. Report Download

The "Download Report" option allows parents to export summaries, including aggregated usage metrics and AI-driven recommendations, in Excel or PDF format for offline review or sharing.

5. Secure Logout

To maintain system integrity and protect sensitive data, the user securely logs out, terminating access and preventing unauthorized use.

DATA PIPELINE PROCESS IN THE DIGITAL WELLBEING APPLICATION

The process begins with users securely logging in to access the app's features for monitoring and analysis. Once authenticated, the system automatically gathers device usage data in the background, with an optional feature for manual data input if needed. The collected data is then processed—cleaned, structured, and formatted—to ensure consistency and usability for analysis. Parents can then choose to view interactive dashboards or download reports, which provide aggregated metrics, trends, and recommendations for offline use. The session concludes when the user logs out, ensuring that all data is securely stored and that the entire process is completed with privacy and integrity maintained..

RESULTS AND EVALUATION

SampleRecords

The screenshot illustrates example entries from the raw usage data, which are automatically collected from the child's device and stored in Firebase. Key fields include App_Name, Category, Session_Duration, Launch_Count, Date, and Device_ID. These attributes form the core dataset captured during the monitoring process. The data undergoes processing, including normalization of session durations, categorization of apps into productivity, social media, or entertainment, and enrichment with summary metrics, preparing it for further analysis and visualization.

Aggregated Data by Category

The processed data is then aggregated to provide meaningful summaries, such as total screen time per app category, average session durations, and frequency of app usage. These aggregated metrics allow parents to understand usage patterns, identify overused applications, and make informed decisions for setting limits or enabling focus modes. The structured and enriched data serves as the foundation for interactive dashboards and downloadable reports, facilitating both real-time insights and offline review.

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BACKEND DATABASE COMMUNICATION

In the Digital Wellbeing application, Firebase serves as the backend database, providing a structured and secure environment for storing user and usage data. Within Firebase, collections and documents organize the data into a clean and manageable layout, similar to schemas in relational databases. Key collections include UserProfiles, AppUsageRecords, and AggregatedMetrics, which store details such as app names, session durations, screen-on times, and category summaries. Administrators or parent dashboards can query these collections to retrieve real-time or historical usage data. The Firebase console provides an interface to inspect collections, view individual documents, and run simple queries for analysis or debugging purposes. Security rules and structured document fields ensure that only authorized users can access or modify data. This setup enables efficient data management, supports interactive dashboards, and allows seamless integration of AI-driven insights while maintaining data integrity and accessibility across devices.

AFTER AGGREGATION DATA

After processing and aggregation, the Digital Wellbeing application generates summary metrics, such as total screen time, average session duration, and app usage frequency per category, which are stored in Firebase under the AggregatedMetrics collection. These summaries can also be exported as Excel or PDF reports for offline viewing. Parents or administrators can load these reports into visualization tools or directly access the app's interactive dashboard, where charts, graphs, and trend analyses display usage patterns clearly. The visualizations help identify overused apps, peak usage times, and behavioral trends, enabling parents to make informed decisions about setting time limits, activating focus modes, or adjusting app access. These aggregated insights ensure that digital wellbeing management is both actionable and data-driven, providing a clear overview of device usage for monitoring and intervention..

VISUALIZATION IN DASHBOARDS

In the Digital Wellbeing application, interactive dashboards display aggregated usage data for parents. The dashboard interface provides tools to import and visualize data collected from Firebase, including metrics like app usage, session durations, and category-based summaries. Visualizations such as pie charts, bar graphs, and line charts clearly present patterns of device usage, highlighting overused apps, peak usage times, and category-wise screen time. The dashboard allows dynamic filtering, enabling parents to view data by date, app category, or specific apps, while values and fields can be adjusted to customize insights. The data pane shows the structured dataset, ensuring that all metrics are correctly loaded and formatted for analysis. This setup offers a clear, interactive, and real-time view of digital habits, allowing informed decisions to manage screen time effectively..

6. CONCLUSION

The Digital Wellbeing and Parental Control application delivers a complete end-to-end solution for monitoring, analyzing, and managing device usage, transforming raw usage data into actionable insights. The system integrates modern technologies such as Java and Android Studio for app development, Firebase for secure data storage and real-time synchronization, and interactive dashboards for visualization, creating a scalable, robust, and user-friendly workflow. At its core, automated data collection and processing enable efficient handling of large volumes of usage data, while background services normalize, categorize, and aggregate metrics such as screen time, app frequency, and focus periods. The application supports offline reporting through downloadable Excel or PDF summaries, and interactive dashboards provide parents with clear visualizations to identify trends, overuse patterns, and opportunities for intervention. A structured testing plan—including integration, acceptance, and performance checks—ensures accuracy, reliability, and scalability of the system. By automating monitoring and analysis, the project reduces manual effort, eliminates inconsistencies, and provides timely insights for informed decision-making. Future improvements could include real-time AI-driven recommendations, emotion-aware notifications, and predictive alerts to further enhance digital wellbeing management. Overall, the project establishes a strong and flexible framework for promoting healthier digital habits and empowering parents to guide device usage effectively..

7. REFERENCES

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