International Journal of Engineering and Techniques - Volume 12 Issue 3, May-June - 2026

RESEARCH ARTICLE OPEN ACCESS

Nidra App (Smart Sleep Hygiene)

Sanskar Virat[1], Ann Kurian[2], K.Shruti[3], Kunal Bagal[4], Ankita Kumari[5], Shahin Nadaf[6]

1(*B.Tech CS & E, Dr.D.Y.Patil Dnyaan Prasad Global University, Pune, India*
Email: sanskarvirat3@gmail.com)

2(*B.Tech CS & E, Dr.D.Y.Patil Dnyaan Prasad Global University, Pune, India*
Email: annkurian200@gmail.com)

3(*B.Tech CS & E, Dr.D.Y.Patil Dnyaan Prasad Global University, Pune, India*
Email: kshrutii06007@gmail.com)

4(*B.Tech CS & E, Dr.D.Y.Patil Dnyaan Prasad Global University, Pune, India*
Email: bagalk073@gmail.com)

5(*B.Tech CS & E, Dr.D.Y.Patil Dnyaan Prasad Global University, Pune, India*
Email: ankita23k07@gmail.com)

6(*B.Tech CS & E, Dr.D.Y.Patil Dnyaan Prasad Global University, Pune, India*
Email: sahinnadaf969@gmail.com)

Abstract:

As we continue to live in a globally interconnected and instantly accessible world, we are increasingly dependent upon smartphones for everything we do and everywhere we go. Unfortunately, using our smartphones immediately prior to going to bed negatively impacts our quality of sleep and how well we feel upon waking. This research paper reviews the problems associated with the use of smartphones prior to sleep such as being distracted by endless scrolling, autoplay, and notifications from our devices, contributing to a rise in the number of late-night bedtimes. In order to reduce the amount of time spent on our smartphones, we have created a product called "Nidra", which is designed to aid in the reduction of smartphone usage by providing discouragement of smartphone usage during the hours leading up to sleep and promoting good sleep hygiene in general.

Keywords **— Sleep Quality, Digital Distraction, Screen Time Reduction, Nidra App, Healthy Sleep Patterns.**

I. INTRODUCTION

Smartphones have risen to an all time high usage level in today's society. They have exposed the user to various forms of interface design that try to catch the user's attention. Examples of these interfaces include features like "infinity scrolling" and a vast amount of "push" notifications that provide users with constant stimulation (even while they are asleep), which leads to a lack of quality sleep for the user and can also harm his or her mental health.

The Significance of This Issue is Cognitive function, including creativity, emotional regulation, and attention, is affected by lack of sleep. The trend of ever-increasing use of digital devices indicates the call for solid, gentle ways to disconnect from the technology.

Nidra is the first smart solution that leverages an innovative use of behavioural design techniques in an effort to facilitate the reduction of phone use during nighttime hours. Other systems typically accomplish this by imposing a variety of rules/restrictions on their user base, but Nidra instead seeks to "entice" a user with environmental changes to encourage them to sleep.

II. MOTIVATION AND OBJECTIVES

A. Motivation

The primary reason why the approaches that are used now, such as2 limiting the amount of screen time or limiting the use of apps, are not working is that they heavily rely on human self-control, which is very difficult to attain because technology nowadays is designed in a way that makes it impossible to resist.

B. Objectives

- To construct a mechanism where technological disruptions are reduced before going to bed.
- To adopt behavioral design techniques in order to promote healthy sleeping habits.
- To create a personalized sleep schedule.
- To develop an intelligent sleep schedule that will help people transition into sleep.

III. RELATED WORK

The current research on health and digital wellbeing is divided into two main areas: systems for monitoring our bodies and

systems for controlling our behaviour. There are three types of research in this area:
* interventionist alarm systems
* automated device control
* non-intrusive sleep-stage monitoring systems.
Interventionist alarm systems and behavioural triggers have become popular for using factors to help people wake up. A recent study by Chen et al. [1] Introduced an idea that uses social anxiety to help people wake up on time by making them responsible to a social group.
Oh et al. [2] Also did a study on task-based alarm clocks. Found that requiring people to engage in a task right after waking up can help reduce sleepiness.
Gupta et al. [2] Developed an Android app that uses UI elements to prevent people from scrolling through their phones excessively.
Earlier studies have also looked at context- auto-lock systems that adjust screen timeouts based on where the user is and what they are doing.
However these systems usually rely on fixed time limits or location cues than real-time biological data.
Non-intrusive sleep-stage monitoring has made progress with the use of AI and IoT.
A latest study by Jaffer et al. [3] Proposed a sleep tracker that uses pulse oximetry and machine learning to differentiate between different sleep cycles.
Other studies have also found that smartphone usage patterns can accurately predict sleep duration suggesting that monitoring phone usage can replace sleep diaries.
These monitoring tools are good at tracking what is happening. They cannot actually do anything to help people sleep better.
Looking at what other people have found we can see that hardware-based trackers like IoT and Arduino are good at measuring what is happening in our bodies.
On the hand mobile applications that run on software are better at reaching more people and helping them change their habits.
The techniques used vary from analysing frequencies and actigraphy-based prediction to system-level OS restrictions.
Monitoring systems provide high-resolution data visualization whereas interventionist systems focus on immediate wake-up compliance.
The proposed system overlaps with existing work, in its use of system-level app-locking and sleep-stage analysis.
However it differs fundamentally in its integrated -directional architecture.
Unlike systems that merely track data or rigid lockers that lack biological awareness this work fills the gap by creating an automated feedback loop.
Other recent approaches in digital wellbeing include sleep deprivation detection algorithms [4], evaluations of parental control filtering [5], sleep stage prediction models [6], unobtrusive smartphone tracking [7], and mobile gamification [8].
It moves beyond the " monitoring" paradigm into a "proactive intervention" model where live sleep cycles directly dictate device accessibility.

IV. RESEARCH GAP

However, most of the sleep management solutions that currently exist concentrate on sleep tracking and reporting of the results. They provide information on the amount of sleep and its peculiarities; nevertheless, they do not offer help in improving the situation. The burden lies with the user, and no actions will be taken unless he or she takes care of the issue personally.

There is a shortage of solutions for controlling the actions of the users. No matter what suggestions might be given, the user may choose to disregard them and use his or her phone at night anyway. Only very few programs deal with the root cause, which is excessive use of a mobile device before sleeping. Moreover, many solutions fail to combine usability and restrictions because they either do not have any restrictions or limit too much, including in emergencies.

Nidra manages to overcome these problems through direct intervention into the process. It automatically sets up an alarm depending on what time has been specified by the user and restrains from working the programs that distract from falling asleep. However, it allows contacting in case of emergencies.

V. PROPOSED APPROACH

Project Nidra uses three layers of architecture to keep things separate, protect data, and improve battery life. The three layers are: the Presentation Layer, the Application Logic & Persistence Layer, and the Native Platform Layer.

A. Presentation Layer: React Native UI

The user interface (Frontend) was made using React Expo and expo-router. The UI has a carefully chosen dark color scheme and custom Google fonts (Inter and Lora). This makes the app feel much more comfortable to use during the late hours.

- **Data Visualization:** The hard work of rendering charts is moved to the GPU with React Native and victory-charts to ensure smooth rendering.
- **Data Flow:** The UI does not store any important variables itself, rather this work is directed to Zustand (as will be discussed in 5.1.2). This keeps the re-rendering to the minimum.

B. Application Logic and Persistence Layer: Zustand with SecureStore

All of the mutable states (user identity, sleep goals, blocklists) and domain logic is controlled by a central Zustand store.

- Encrypted Persistence: An expo-secure-store custom adapter is used to store the state. Sensitive user data is encrypted by Android Keystore when it is not in use.

- Session Hydration: Even when the app is closed completely, the user login and the active sleep protocol is stored, so the user does not lose their session data. So when the user starts the app again their login and sleep protocol are restored..

C. Native Platform Layer: Android Kotlin Bridge

To connect React Native to Android's OS Level features:

- Event Driven Blocking: Instead of using polling to check the app's open state, Nidra uses an Android Accessibility-Service to find out when a restricted app is opened and instantly overlay a full screen system overlay. As a result, very little CPU power is used.
- Native Persistence: As the blocklist needs to be accessible even after the app is closed and to survive Android memory wipes.. For this the blocklist is stored in SharedPreferences due to its very small size.
- The Bridge: Due to multiple layers of the app, there needs to be a bridge of communication so the React Native app can actually talk to the OS. This is why Kotlin was introduced in the project.

Communication Path	Mechanism	Data Flow
UI → State	Zustand typed selectors & action dispatches	User interactions trigger store mutations
State → UI	Reactive subscriptions (auto re-render on slice change)	State changes propagate to subscribed components
State → Persistence	Zustand **persist** middleware	Automatic serialization to encrypted SecureStore
State → Native	**NativeModules.Sleep-Blocker** bridge calls	Blocked app list sync, service start/stop
Native → OS	AccessibilityService event callbacks	Foreground app detection, overlay rendering
Native → UI	Promise-based async returns	Permission status, installed app enumeration

Table 1. Inter-Layer Communication Summary

The flowchart below is a complete life cycle of a Sleep Mode Session. From user pressing "Start Sleep Protocol" on the page to OS level.

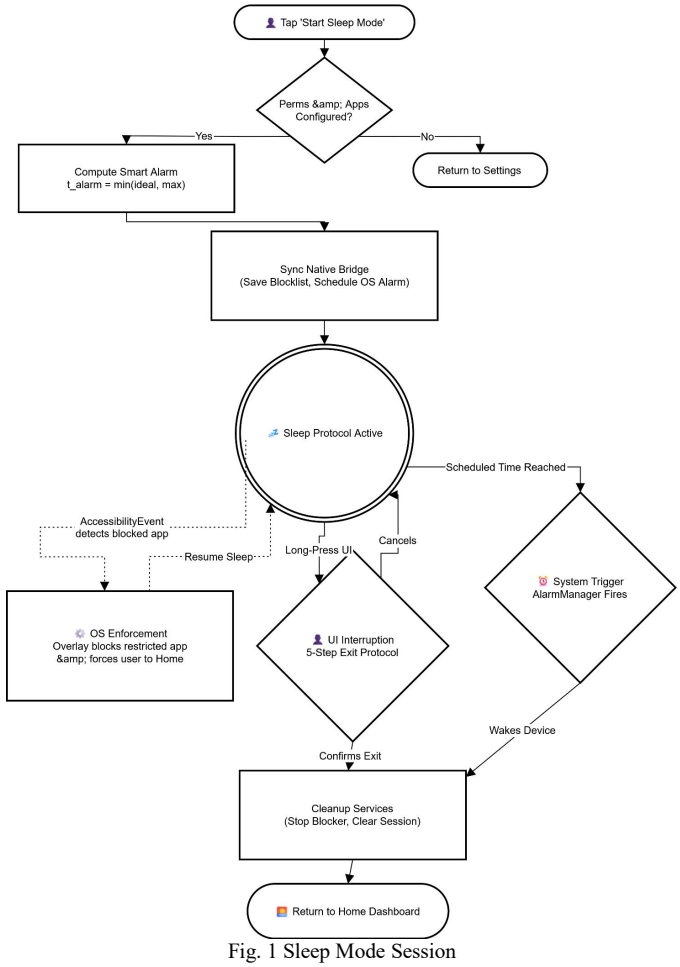

Fig. 1 Sleep Mode Session

VI. ADVANTAGES AND LIMITATIONS

A. Advantages

- The Nidra App helps users to improve their sleep practically. The main advantage is that the app not only sets an alarm but also guides the user on when to sleep based on the wakeup time and sleep hours. This makes Nidra more useful than other apps.
- Another advantage is that the app locks the unnecessary apps, which reduces distraction during sleep time. This helps users avoid late-night scrolling, which is a common problem seen nowadays.
- The app is also easy to use, as only a few details need to be added, and the app handles the rest automatically.

B. Limitations

- One disadvantage is that restricting apps may feel inconvenient and annoying, especially if you are unfamiliar with such strict parameters. Users may try to deactivate the restrictions.
- Another limitation is that if the user enters incorrect information, the app will give wrong insights. And without advanced features, it may not provide precise results.

- There could be technical limitations, such as it may not be compatible with different devices, or restrictions may not work properly on certain operating systems.

VII. APPLICATIONS

- The app can be useful for students who stay up late and spoil their sleep schedule by watching on their phones late at night. This may help them to improve and manage their sleep time better and focus during the day.
- It can be used by working individuals who work late at night and want to manage their sleep with their busy schedules. The app is helpful for anyone who wants to reduce their screen time at night and improve their sleep cycle.
- At last, the Nidra app is useful in daily life for promoting healthy sleep patterns and improving productivity with overall well-being.

VIII. CONCLUSION

One thing we learned from this project is that among other factors, heavy usage of smartphones at night causes bad sleeping habits. The Nidra app aims to tackle this by introducing an alarm feature alongside app restrictions. Asking the user when they want to wake up and how long they want to sleep will help the app set a suitable schedule as well as limit the distractions that arise in the sleep cycle.

The Nidra app introduces another technique to sleep tracking. As opposed to simply tracking, it concentrates on behavior modification. This way, the restriction of apps in the sleep cycle but not all the apps are restricted. This would prove helpful to users who struggle with quitting using their phones at night.

There are some enhancements that can be done to the app in the future, including adding AI and machine learning algorithms to make more accurate predictions from how the user utilizes the app. Integrating with wearable technology will be a smart move for getting accurate results regarding sleep tracking.

ACKNOWLEDGMENT

We would like to thank our college School of Technology and Research at Dr. D. Y. Patil Dnyan Prasad University, Pune, for their institutional support and resources. We would also like to extend our gratitude to our project guide ,Prof. Pooja Lahane , as she mentored us and gave us constructive feedback throughout the development cycle.

REFERENCES

1. *Yu-Che Cheng, Hasio-Yue Tsao, "Design and effectiveness analysis of an alarm clock app to promote behavior change through anxiety," IEEE Conference Publication, vol. 12, no. 4, pp. 112–118, 2024.*

2. *Siddharth Gupta, P Babu and S. Singh, "Android app-locker for security and application management," 5th International Conference on Advances in Computing, Communication Control and Networking (ICAC3N), vol. 5, no. 1, pp. 302–308, 2024.*

3. *Tim Seibert, Guillaume Seigle, Mikhail Gromov, Jafar Saniie, "Architecture and design flow of a smart sleep tracker," IEEE Conference Publication, vol. 15, no. 3, pp. 210–225, 2025.*

4. *R. Juwono and M. V. C. Maluenseng, "Sleep Deprivation Detection Using Bed Time Prediction Algorithm," 2020 IEEE International Conference on Sustainable Engineering and Creative Computing (ICSECC), 2020.*

5. *N. Rojas, N. A. Boettcher, P. Palacios, and I. S. Salazar, "Technical Evaluation of Android Parental Control Tools and PDNS Filtering Services: The Chilean Context," IEEE Access, 2024.*

6. *K. Slyusarenko and I. Fedorin, "Smart alarm based on sleep stages prediction," 2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), pp. 3062–3065, 2020.*

7. *Z. Chen et al., "Unobtrusive sleep monitoring using smartphones," 2013 7th International Conference on Pervasive Computing Technologies for Healthcare and Workshops, pp. 145–152, 2013.*

8. *M. Naing, K. Aung, and L. Tun, "Improving Sleep-Wake Behaviors Using Mobile App Gamification," Journal of Medical Internet Research, vol. 26, no. 5, pp. 88–102, 2024.*