DECO3800

Milestone 3

Design Proposal - CatBT-I

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1.0 Overview

University students don't prioritize sleep as part of their life balance in large part due to leisure time spent on technology and university responsibilities.Our proposed solution, *CatBT-I* aims to address this issue, by educating university students on the importance of *sleep hygiene*, discouraging screen usage before bed, and instilling healthy habits that will overall improve the quality of sleep, and in turn, overall health and performance of these students.

This report documents the steps taken to develop *CatBT-I*, outlining academic, user, and market research, and the design specifications of our final proposed design. Our chosen target audience is university students aged between 18-23 who experience poor quality of sleep due to poor sleep hygiene habits.

Poor sleep quality in university students is a common issue, and as will be discussed in section *2.0 Academic Research* has significant effects on the mental health and academic performance of students. Thus, a design that could address such issues could significantly improve the wellbeing of students.

2.0 Academic Research

Feedback Integration: *Since the feedback regarding milestone 2, it was clear that it didn't seem like there was much elaboration and explanation regarding some of the concepts we'd listed, particularly the influencing factors. As a result we have attempted to expand upon and better explain the information/insights we'd actually gained from our sources. There was the worry of overall page space though, so we couldn't inflate our explanations too much.*

2.1 What is PSQI

The PSQI (Pittsburgh Sleep Quality Index) is a widely used questionnaire developed by researchers at the university of Pittsburgh used to measure quality of sleep. Participants are assigned a score based on the metrics of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleeping medications, and daytime dysfunction. A score of 0 indicates no sleeping difficulties, 1-7 indicates mild, 8-14 moderate and 15-21 severe. This metric will be utlised in our user research.

2.2 Effects of Poor Sleep Quality in University Students

Studies suggest that 50% to 80% of university students in countries like Australia, Portugal, England, and the USA suffer from poor sleep quality, and that there is a link between poor sleep quality, lowered academic performance and diminished life satisfaction (Humphries et al., 2021). This is a result of daytime dysfunction, reduced cognition and excessive tiredness caused by poor sleep quality, as well as the difficulty of balancing academic demands, social life and external responsibilities (Ali et al., 2023). Sleep latency, which is the time it takes to fall asleep, sleep quantity, and sleep depth, which is often inferred by the frequency of dreams and periods of REM sleep, are some of the most significant sleep problems faced by university students (Qiu et al, 2019).

2.3 Sleep quality and first/second year university students

According to a study conducted on 540 students undertaking medical degrees revealed that students in their first and second years of study are more likely to experience poor sleep quality, and greater daytime dysfunction (Correa et al, 2017). This may be because first and second year students may have difficulty transitioning from high school to university, due to the increase in freedom of their schedules, and more responsibility over their time management (Ali et al., 2023).

2.4 Influencing factors of sleep quality

Sleep hygiene refers to behaviors and habits that can improve one's sleep, including practices like minimizing screen time, avoiding stimulants, adhering to regular sleep schedules, and maintaining a conducive sleep environment. Studies reveal that poor sleep hygiene is a major determinant of poor sleep quality.

Screen Usage

Extensive use of phones or laptops in the hour before bed significantly delays sleep onset and reduces overall sleep quality. According to a 2011 survey, 19-29 year old participants engaged in screen use before sleep, reporting issues such as difficulty falling asleep, frequent awakenings, and daytime fatigue (Herschner. S et a).

The use of mobile phones resulted in repeated awakenings and waking up too early, with around 57% of young adults leaving their phones on during sleep. Furthermore video games engagement on electronic devices within approximately one hour bed resulted in a 21 minute increase in sleep latency (SciFlo Brazil, 2010).

According to SciFlo's 2010 study, the timeframe and proximity to electronic screens emitting blue light largely affects quality of sleep. The study revealed that exposure to light before midnight leads to delays in the circadian phase, whereas exposure after midnight induced phase advances, changing overall sleep cycles(Yeluri. K, 2021).

Revenge bedtime procrastination

This phenomenon refers to delaying sleep as a way to reclaim personal time lost to daily responsibilities. Many students engage in nighttime screen use as a form of unwinding, despite knowing the adverse effects on sleep.

Revenge bedtime procrastination greatly exacerbates the existing challenges university students face with sleep. Studies reveal that nearly 30% of participants, approximately half of which attended university, reported sleeping only 6 hours or less on weeknights (Kroese et al., 2014). The study also found that bedtime procrastination correlates with reduced self-regulation, and that frequent procrastinators report shorter sleep and more frequent fatigue. This pattern, combined with high academic and social demands, further diminishes overall sleep quality. (Kroese et al., 2014).

Irregular Schedules and Caffeine Use
Research by Hershner University students are often “night owls” due to lifestyle and developmental factors, with irregular schedules contributing to inconsistent sleep patterns. Students typically experience a 1–3 hour sleep deficit on weekdays, followed by "catch-up" sleep on weekends (Humphries et al., 2021).

Humphries’ research linked such schedule fluctuations to disrupted sleep quality, with students frequently turning to caffeine to maintain alertness, which itself increases sleep latency and reduces REM sleep, worsening overall restfulness (Humphries et al., 2021)

Stress
Academic stress from coursework, exams, and deadlines affects both mental and physiological states, often delaying sleep onset and reducing sleep depth. Correa’s research highlights that stress activates a hyperarousal response, preventing smooth transition into sleep and causing frequent interruptions. Trockel’s study on e-CBT (electronic cognitive behavioral therapy) demonstrated that reducing depressive symptoms and stress through structured interventions effectively improved sleep among students, underscoring the importance of stress management in sleep interventions (Correa et al, 2017. Trockel M, 2011).

Napping
When strategically timed, naps can mitigate sleep deficits. Short naps (10–20 minutes) enhance alertness, but longer naps or those taken late in the day can induce sleep inertia and disrupt night sleep. Many students use naps to compensate for poor nighttime sleep, potentially reinforcing harmful sleep habits. Research suggests that while napping may alleviate short-term effects of sleep deprivation, reliance on long or late naps often perpetuates the cycle of poor sleep (Lovato N et al,2014. Mayo Clinic, c2024. Takahashi M, 2003.).

These findings emphasize that sleep quality in university students is closely linked to their behaviors and habits. The concepts discussed in this section will be utilized and referred to in further sections.

3.0 Stakeholders

3.1 Primary stakeholders

First and second year university students
The primary demographic the design will be focused around. This group has shown in study to be particularly vulnerable to poor sleep quality due to having to adapt to and juggle their newly gained social and academic responsibilities, leading to the increased chances of developing poor sleep hygiene habits.

The solution we would create aims to put more focus on their sleep issues, improving academic performance, mental health and overall life satisfaction through encouraging better sleep hygiene and improving sleep quality.

Within this primary demographic it is important to consider the sub groups by the manner in which they could be affected by a solution relating to sleep. In particular this includes: the sub group who could see beneficial sleep improvement through habit change, this would be the targeted group. Another group would be those who suffer from insomnia, this is a notably different condition from poor sleep hygiene, and often requires a heavily involved solution. It is also important to not market an ill-fit solution to this group as this could potentially worsen their condition.

Upper year university students
Although first and second year students are the main focus, students of all years have shown struggles with poor sleep hygiene and attaining consistent/adequate sleep quality. While our solution may design leaning towards discipline and early organization elements helpful for freshmen, it would still be applicable to those with the same problems.

University admin and student health services
University faculties or administration may support such a solution should it lead to healthier, more productive students. If our proposed solution is able to noticeably improve student wellbeing or academic performance, it may be recommended or endorsed by academic institutions. Furthermore, if the solution proves effective, it could be extended to the workforce. Employers might then take interest, as it could enhance productivity, workplace culture, and employee well-being.

3.2 Secondary stakeholders

Parents and families
Families would be indirectly impacted as they would, ideally, be concerned about their children's well-being and academic performance. Families of first and second years students could have increased relevance in particular as these students may still have some instability regarding such aspects.

Parents and guardians may benefit from knowing their children are adopting healthier habits in attempts to maintain and improve their academic and mental health outcomes.

Medical professionals
With regard to medical professionals or sleep experts, ilt may be to the detriment if students utilizing the solution neglect medical treatment where necessary, lessening the demand for such services. Contrarily, if the proposed solution is successful, it may be recommended by professionals to students or others as a supplement to professional treatment which may be to the benefit of both stakeholder groups, where additionally, our solution could potentially be integrated into current treatment plans, enhancing the effectiveness of medical care.

Sleep researchers
Public health professionals or researchers looking into the field of sleep quality may be interested in the solution itself, using it to inform broader studies of sleep health.

The research data that they acquire could potentially contribute to the larger body of knowledge about sleep hygiene and its' impacts on academic performance and mental well-being in students, or other target audiences they attempt to use it on.

4.0 User Research

Feedback Integration: *From the feedback we were given, due to page and time constraints we wanted to act upon what we believed to be most urgent for improvement. There was a lot of feedback talking about how we should break down our analysis more, so we had decided to incorporate a final thematic analysis addressing the key lessons we learned from each research activity and how they may have influenced our solution directions. Additionally we attempted to briefly explain our overarching thoughts, and goals behind each user research method.*

To better understand the target audience, we began a user research phase focused on understanding the quality and quantity of sleep among college students. The goal was to identify key issues and possible solutions in this area. In particular, psychological factors, behaviors, and habits that affect sleep.

4.1 Interviews

In the first stage of our user research, six interviews were conducted with university students to obtain a foundational understanding of the issues and potential solutions pertaining to sleep quality and quantity. A standardized interview protocol was developed to ensure that the responses remained consistently relevant across participants. The questions were designed to elicit detailed insights into participants' sleep schedules, associated habits, and the consequences of those habits. The primary aim of this protocol was to identify and examine surface-level patterns in sleep quality and quantity, specifically within the target demographic of university students.

The methodology used for the creation of the questions and overall conduct with participants followed more the concept of "unstructured interviews". Despite having a list of questions that we would ask to evoke particular types of responses, the phrasings were intended to be open-ended, and our demeanors casual, allowing participants to go on tangents and elaborate greatly if needed. The questions focused on exploring sleep schedules, behaviors, and their respective impacts on participants' overall sleep patterns. For a comprehensive list of the interview questions, please refer to 11.1 Interview Protocol in the appendix. And for the transcripts of the conducted interviews refer to 11.2 Interview Transcripts in the appendix. A preliminary analysis was performed on the results of the interviews, several key factors associated with positive and negative sleeping patterns were identified.

Some of the most important conclusions made however were that:

- Late-night thinking and anxiety. Many college students report having late-night thinking, which is often associated with anxiety and difficulty concentrating. Affecting the ability to fall asleep on time.

- Use of technology like phones/computers/laptops could impede timely sleep, linked primarily to a lack of self-control and discipline (social media, YouTube, etc).
- Obligation was an important factor when considering a "sleep schedule" and in maintaining consistency. Obligation could be both beneficial and detrimental to timely sleep, being associated with university classes as well as work/life responsibilities.
- Some individuals' sleeping habits could be more “circadian rhythm” based, only deciding to fall asleep when they feel tired, circadian rhythm misalignment being a prevalent factor in lack of sleep.
- Students may know that "not enough sleep is bad" but may not fully comprehend its negative consequences and importance especially relating to their cognitive ability. (Students staying up and ruining their schedules for finals)
- Having ambient noise at night could positively influence the speed of sleep, preventing negative thoughts from spiraling.

From the discussions in the interviews and conclusions drawn, thoughts related to “keeping a sleep schedule” or “going to bed on time” looked to be linked towards concepts like responsibility, habits, discipline, and perceptions. Therefore, when combined with the academic data that has been found referencing the correlation between psychology/behavior and sleep quality in college students, concepts that influence sleep perceptions and understandings seemed to be particularly important when considering solutions.

4.2 Interview Results Analysis

The key findings from the interviews were grouped in the below affinity diagram.

4.3 Sleep Diary

Our second phase of user research involved conducting a sleep diary study, where each of our members were tasked with completing at least five entries. These entries would consist of information about how the participant was feeling before and after sleep, and any factors that, to our knowledge from previous academic research, may have affected quality of sleep. The structure of the diary was left free for each participant, as the approach aimed to be reflective in nature.

This study was conducted in order for our design team to connect with our end-user base, and potentially identify any sleep-related challenges that were particularly challenging to overcome

in our own routines. Such challenges may not be able to be revealed through academic research, or secondary data from user research, such as those collected through interview responses.

4.4 Diary Results Analysis

One of the most obvious patterns is that all participants had significant screen usage before bed. This may have affected their sleep quality again due to the research outlined in section 2.3, and as participants stated “woke up unnaturally to their alarm clock” or “woke up feeling groggy/dizzy.” It is apparent that most of the group would be working on university assessments or coursework leading into their bedtime, often for over an hour. Additionally, participants would use their devices to unwind or do something unrelated to their academics before bed in order to wind down. For instance, person 1 and 6 would play a game or watch videos, person 3 would read on their device or also watch videos, person 3 would watch an episode or two from a streaming service. Many of these routines involving screen time were habitual and would span over multiple entries.

Many participants in their entries stated that they received less than the recommended amount of sleep, which the PSQI (Buysse et al., 1989) states is greater than 7 hours per night. Participants averaged 5-7 hours per night, and despite this, showed little urgency or effort to improve this figure. Person 3 wrote that they “hate the alarm clock in the early morning,” after stating that they did not have enough sleep. Person 1 and 4 often had 6 hours of sleep or less, with person 4 even recording an entry with 4 hours of sleep. Due to obligations such as assignments and work, participants had trouble prioritizing their sleep, often simply tolerating the tiredness or had grown accustomed to it. As one participant wrote, “I think the lack of sleep might have passively affected me at work, but I generally don't feel tired when working, only when I get home does it actually hit.” In one entry after only 5 hours of sleep, person 1 wrote, “I feel mostly rested.” From this experience we as designers have personally struggled with prioritizing our sleep over obligations, and as a result we tolerate lack of sleep or poor sleep quality. This has provided insight into the difficulty our target audience faces.

The sleep diary was an important tool in understanding and experiencing the connection between daily obligations and stress with sleep patterns, providing insights that are hard to capture with other research methods such as surveys or interviews. As Person 1 pointed out, "Sometimes I stay up even when I'm tired because I'm worried about unfinished work." This reflects how students' sleep habits are shaped by stressors in their immediate environment, such as academic pressures, which are often neglected in broader research.

In addition to this, Person 3 highlighted how upcoming deadlines and obligations can interfere with sleep, stating, "Because there is a due on 12 Sep, still have a lot to do, stressful, can't have a good sleep." By documenting such moments, the diary provides a real-time narrative that connects the weight of obligations with poor sleep quality. This realization is especially valuable for our design project, as it provides us with direction to potentially target underlying causes of sleep disruption, such as stress. By integrating features that acknowledge these stressors, like academic deadlines or emotional strain, we could help users manage their responsibilities while promoting healthier sleep patterns.

4.5 Survey

For the third stage of our user research, our team conducted a survey to find the specific problems university students had in maintaining good sleep and methods they use to mitigate the effects of poor sleep quality.

The goal for the creation of our survey was to attain supporting information to supplement the findings and patterns identified from our previous user and literature research. There were a number of concepts and questions where we wanted to observe their occurrence, if any, within our target audience. So we included a mix of quantitative and qualitative questions that probed once again for issues within the problem space as well as patterns in behavior that could correlate, for example questions 5 and 4 respectively (Survey questions can be found in appendix 11.5 Survey Questions). Among these behavior targeted questions, we also included a question section specifically related to gauging a user's PSQI score, so that we could have an "objective" measure of a user's sleep quality to compare with their behavior data.

We sent out our survey through solicitations and a forum post and received 21 responses. We found that our participants have an average PSQI score of 7 out of 21 which might indicate poor sleep quality among University students. We also found that 17 participants (80%) reported that the main barrier they had to improving sleep quality is related to responsibility demands and time management. Other factors that impede the majority of our participants from getting good sleep includes stress or anxiety, irregular sleep schedule, and use of technology before bed. On the use of technology, 12 participants (57%) reported spending 45-60 minutes on a device with 11 of them reporting the purpose of the screen time being related to leisure.

4.6 Survey Results Analysis

57.4% participants indicate that they can't have 8 hours sleep

University students often face a heavy academic workload and have difficulty balancing academic responsibilities and personal lives, often requiring them to sacrifice sleep time. This forces students to prioritize studying over rest or vice versa. Students' schedules for activities often vary, and it is difficult to maintain a consistent schedule, resulting in students not allocating enough sleep time.

As mentioned earlier, many students spend a lot of time on their devices before bed, which reduces the time available for sleep and also affects sleep quality due to the disruption of the biological clock caused by the stimulation of screens.

Napping is not a solution for recovery to everybody

Different people have different genetic and physiological conditions, and this difference may be related to personal sleep needs, physical health and lifestyle habits. The effect of naps often depends on the time and duration. The effect of nap length on people is divided into two extremes. In addition, naps close to bedtime may affect the quality of sleep at night. These concepts have also been mentioned in our previous academic research.

Phone Usage Before Bed
57.1% participants state that they spend more than 45 mins on their phone in last hour before going to bed, indicating students continue to use electronic devices after bedtime, causing them to spend a significant amount of time in non-sleep activities in the first hour after bedtime that delay sleep. Spending too much time in bed without effectively preparing for sleep may prevent individuals from fully relaxing. Ideally, bedtime activities should not increase stimulation and stress. This poor time management may reflect their challenges in using time effectively.

4.7 Final thematic analysis

When considering all of our user research findings in totality, and look at key issues and ideas extracted from the users in each activity, there are a number of themes that can be identified.

1. Technology Use Before Bed
The use of electronic devices before bedtime emerged as a significant theme during the design process. Participants consistently reported that they often used digital devices for leisure activities late at night. Several students mentioned that they had a hard time resisting the "temptation" of the Internet. Different studies and participants' use of technology have shown that online content, coupled with harmful blue light, plays an important role in sleep hygiene and quality. This technology intentionally postpones the scheduled sleep time, which leads to "retaliatory bedtime procrastination."

Therefore, this suggests that a solution is needed to address or intervene in the use of technology "before bedtime" to enhance students' sense of responsibility and priority.

2. Stress and Cognitive Overload
Academic and social stress was another major theme that impacted sleep quality. Survey and interview responses highlighted how stress can lead to disrupted sleep continuity. In sleep diaries and survey activities, participants frequently noted that worrying about academic obligations can be a barrier to regular sleep. Therefore, there does appear to be evidence that students feel mentally exhausted during the day due to lack of sleep.

This stress-induced wakefulness pattern highlights the need for solutions focused on relaxation strategies to help students separate their sleep environment from their daily lives.

3. Irregular Sleep Schedules
Students have demonstrated difficulty identifying or adhering to a consistent sleep-wake cycle, which impacts their ability to fall asleep and wake up at an optimal time. For example, some noted that staying up late to socialize or play games made it difficult for them to get up in the morning for class, creating a cycle of inconsistent sleep. This irregularity exacerbates and prevents students from developing consistent sleep habits.

This highlights the need for a tool that can adapt to students’ schedules and lifestyles, giving them a tool to optimize or improve unwanted variations in their sleep schedules.

4. Behavior/Perception and Sleep Hygiene

Covering the nature of some of the previous topics, it is important to distinguish that despite awareness of the negative effects of insufficient sleep, many students also had a limited understanding of the effects of insufficient sleep. Participants frequently downplayed the impact of insufficient sleep. This underestimation often led students to de-prioritize sleep in favor of study time, social activities, or other.

These patterns reflect a general disregard for sleep hygiene and a tendency to employ short-term coping mechanisms despite awareness of their negative effects. This highlights the need for solutions that not only inform students about good sleep habits, but also actively encourage sustained, controllable behavior change.

5. Environmental and Physical Sleep Conditions

A number of insights also point towards the prevalence of the physical and environmental aspects of sleep. A few participants cited specific environmental conditions like needing darkness, white noise, or a comfortable room temperature to improve their chances of falling asleep and staying asleep.

Some preferred ambient noise or white noise as a way to combat intrusive thoughts, while others highlighted the importance of eliminating light and distractions in their sleep space. Students who implemented these environmental modifications noted slight improvements in their sleep quality, implying that such adjustments can make a noticeable difference, also to be noted is that these conditions were also tied to the idea of relaxation, and distracting from stress. Suggesting that by mitigating elements of stress, a solution that adjusts environmental/physical sleep factors has the ability to improve student's sleep quality.

6. Napping as a Sleep Management Strategy

Napping emerged as an interesting method students had used to compensate for sleep deprivation both in sleep diaries and surveys, with mixed results. While some students found napping beneficial for restoring energy, others reported negative side effects, such as difficulty sleeping at night after a long nap. This data suggests that the timing and duration of naps impact determine whether they help or hinder sleep quality (which is a heavily supported notion literature-wise). This theme reveals students would benefit from guidance on how to nap effectively.

5.0 Market Research of Existing Solutions

Market research was done to investigate what technological solutions exist to aid users sleep. This was done with a primary focus on solutions that are implemented through a mobile application. The solutions were found through ranking websites that compile lists of various solutions to problems. This was then supplemented by keyword searches on the google play store. The market research comprises the more popular applications from these two discovery methods but also includes less popular solutions where the implemented ideas are deemed unique and novel. The full list of solutions along with the relevant links used to evaluate them can be found in appendix 11.6.

While this method is not scientific or rigorous the focus of the market research was the ideas and tools presented by the app as opposed to the specific implementation details within the app and therefore this more open and broad research allowed for a wider range of design ideas to be collected, there are also small notes of additional solutions covered in appendix 11.7.

5.1 Solutions with Detailed breakdowns

Solution 1: Apple Watch

The Apple Watch (Apple) is a smart watch with the capability to capture sleep data and implement a sleep schedule for its users. With a simple, small interface the device captures and displays data describing sleep duration, sleep stages, heart rate, motion during sleep and more.

Solution 2: Sleep Ninja

'Sleep Ninja' (Black Dog Institute, 2024) is a free mobile application developed by the Black Dog Institute which aims to help young people aged 12-16 years old address mild to moderate sleep difficulties. The application is recommended to be used for approximately six weeks where users work through six learning modules, input data relating to their sleep, and have access to personal guided routines.

Solution 3: Calm

Calm (Calm, 2024) is advertised as a mental health app helping to manage stress and improve sleep. The primary tools are different audio files to help users relax, these include: "Sleep Stories", Soundscapes, guided meditations, Music, ASMR and more. With the consensus being that different forms of audio help people to relax and unwind.

Solution 4: MUSE

Muse (Muse, 2024) is advertised as a meditation assistance tool and can either be used during the day or when falling asleep. The solution makes use of a head band for various forms of tracking. The app makes use of EEG tracking data to create adaptive soundscapes that change based on EEG tracking data with the consensus being this feedback makes mediation a more enjoyable experience that users are more likely to return to. However, the extra data that is tracked is not utilized very meaningfully and merely exists.

Solution 5: Sleepon

Sleepon (SLEEPON, 2024) is advertised as a sleep tracking tool. It makes use of a wearable ring to track data that is then compiled in an associated app. The ring has lots of tracking capability and the app itself primarily only provides the data to the user and it is on the user to obtain meaningful insights with the census being that this tracking capability is useful for monitoring the effect of other solutions. So, while the ring itself isn't a solution to sleep problems it can help guide the treatment to problems and in some cases the data has been passed on to medical professionals to help track and guide intervention treatments.

Solution 6: Sleep as Android: Smart alarm

This app is used for compiling tracked data from 3rd party wearables. But really does a bit over everything when it comes to sleep tracking. The features include Anti Snoring technology, Sleep tracking of different parameters, Sleep Goals + (A deposit that is refundable once the goal has been met), Sleep noise analysis, Smart Alarm clock to wake you at an ideal time (during a light

sleeping phase), support for napping and polyphasic sleep alarms, + more. Generally the app is liked for sleep tracking and some people make use of the plethora of additional features.

Solution 7: RISE
Rise is a habit and sleep tracking app. With a focus on circadian rhythm, energy levels and sleep dept. The features include daytime habit tracking, Manual or integrated sleep tracking, Calendar integration, Sleep education, Soundscapes and Energy Schedules. Between the daytime habit tracking, sleep tracking, calendar integration and energy schedules the app helps people manage their sleep and improve their overall sleep hygiene.

Solution 8: Stellar Sleep
Stellar Sleep (Twenty Nights, 2024) is an app implementation of CBT-I (Cognitive Behaviour Therapy for Insomniacs) which is a therapy that focuses on cognitive restructuring and changing the way people think about sleep. The app offers an 8 week program to help insomniacs.
The program includes Scheduled Sleep protocol, Sleep education by providing a collection of research-backed information and tips to support better sleep. A human accountability coach, relaxation library and a sleep tracker either manual or through fitness trackers. The implemented approach makes use of sleep restriction. Overall, the implemented approach works for some to help overcome their insomnia with many success stories but as with most therapies' success is not guaranteed and there are many unsuccessful stories.
A small note – out of the 3 CBT-I apps looked at, this one generally seemed to be the highest regarded in regard to user reviews which is why it has been included but at a surface level they seem similar.

Solution 9: Bía
Bia (Bía Neurotechnology, 2024) is an unreleased solution with all listed details in regards to advertised capabilities. Despite being in development the solution introduces many novel ideas that are worth including. Bia is proposed as a face mask and associated app that make use of daytime habit tracking, sleep tracking, and various electronics installed in the face mask to help users to improve sleep, with a focus on helping users control their circadian rhythm.
Daytime: Manual Daytime habit tracking along wit subjective score metrics
Falling Asleep: Soundscapes based on fNIRS (I believe this is similar to how MUSE implements adaptive sound scapes), the mask itself is advertised as being blackout.
During Sleep: Sleep tracking through sensors installed in the mask.
Wake up: Gradual wake up, Sunrise Wakeup (using lights installed inside the mask)
Additionally: The app claims to provide correlation between daytime habits and tracked sleep data

Solution 10: StayOff: Screen Time Control
This app tracks phone & app use in real time and allows users to block apps from being used. App usage tracking and app blocking by either time limit or between certain times and for the most part only serves as a useful reminder requiring the user to still exercise self-control as it is quite easy to bypass the blocking mechanism.

5.2 Analysis of Market Research

A thematic analysis was performed on the tools of the solution finding the following themes:

Education
Anything app inclusion that is intended to educate the user with “static” knowledge – information that is independent of any tracked/personal data

Auditory Relaxation
This includes soundscapes, guided meditations and any form of audio that is intended to help users relax.

Daytime Habit tracking
This includes devices that have you manually log different activities performed throughout the day.

Sleep Data Logging
This includes any tool either manual or automatic that records parameters of a user’s sleep and is intended to be analyzed later. These usually cover sleep duration, sleep phase but some solutions include use case specific data anywhere from O^2 levels to nighttime audio recording. This is a very broad category and groups a lot of distinctly different use cases into one category as certain sleep issues can require very specific tracked metrics.

Insight Metrics
This includes any synthesis of logged data either being habit tracking, sleep data logging or the combination.

Wake up assistance
This includes technology and provides a gentler wake up than the traditional alarm such as devices that monitor the user's sleep phase and wait for an ideal moment to devices that gradually wake the user. Note These features generally aim to prevent over sleeping

Accountability
These are tools that help to offer the user an extra incentive to either follow routine or maintain habits. This includes Stellar Sleeps Accountability coach and “Sleep as Android” payment deposit goals. While not mentioned in the market research, an important accountability tool for CBT-I solutions is the high price point, usually $200 - $300, for most this makes them a large commitment helping with accountability.

6.0 Design Evaluation and Proposal

6.1 Design through Milestone 1

Through the first milestone the primary research conducted was preliminary interviews presented in 4.1 with analysis in 4.2 along with broad problem space research into the sleep of university students with a focus on sleep quality and factors related to this quality presented in 2.2. These activities informed the problem space broadly and derived a number of ideas around the primary cause of the problem resulting in the initial problem statement: University students

often experience sleep deprivation due to the challenges of balancing their academic responsibilities, leisure activities, employment, and social lives.

At this stage solution directions and ideas were vague but the main high level design directions were: 1. Ideas around sleep tracking 2. Ideas around educating users about sleep and 3. Extremely vague ideas about catalyzing a sense of discipline in users

From the first milestone our team was left with more specific considerations about the problem space, being

1. Questions about phone usage before bedtime in regards to duration and its purpose.
2. How late night negative thoughts affect users sleeps
3. Common methods users are already employing to improve sleep

6.2 Design through Milestone 2

The help further our understanding of the problem space and to help answer the previously stated questions from milestone 1 the team conducted two primary means of user research, the first was through the use of a sleep diary (presented in 4.3) performed by each team member for a 5 day period, this was to help deepen our understanding of the problem space. The second was a user survey presented in 4.5 in which we attempted to specially target these questions. Additionally, through this period the team conducted extensive market research of existing solutions, this was to help identify what digital technologies exist that help to target sleep related issues.

The extended user research helped to highlight the key issues of university students which we identified as excessive use of phones before bed and the effects of stress while falling asleep. While less pervasive some other notable issues included: Poor utilization of napping either being unused or with too much duration, Oversleeping on weekends/free days and poor sleep hygiene habits such as stimulant use.

From this our team derived the design direction through applying potential remedies to these identified issues, with remedy ideas coming from either existing solutions outlined in market research or new ideas thought of within the group that while untested have theoretical merit. This resulted in the consideration of the following three design directions:

Idea 1 - Reducing Bedtime Phone Usage

Phone usage was most prevalent finding throughout all the research, it is also thought that this usage not only occurs before bed time but actually eats into bed time itself with activities such as revenge bedtime procrastination and doom scrolling.

Our design idea was to incorporate a form of accountability assistance, helping users stick to and maintain habits and bed times. This could be implemented through a digital solution such as “StayOff” or through a refundable deposit or even by making use of physical solutions such as a blue light detecting device which warns users about phone usage by speaking using the users (or their fathers) voice from pre recorded prompts. With the use of the user's own (or users fathers) voice being used to help build a sense of accountability.

Idea 2 - Reducing effects of stress while falling asleep
As this in itself can be viewed on the spectrum of insomnia this would lead in the design direction of a form of CBT-I, and would make use of tools such as cognitive restructuring to help how users think about bedtime and to see it as a positive experience helping to reduce this anxiety. It is noted that existing CBT-I targeted solutions are often highly involved and offered as an ~8 week program at a high price point. So while these CBT-I have the potential to help many of our target users they are noted to have an extremely high barrier to entry. So our idea would be to create a more accessible version of CBT-I. This approach would also make use of some form of basic sleep tracking and daytime habit tracking. This accessible form of CBT-I would also be paired with some form for auditory assistance to help dull negative thoughts.

6.3 Milestone 3 - Final Design Proposal

Through to the Expo the team worked to refine our understanding of user problems through comprehensive thematic analysis of our research (shown in 4.7), from this we found the primary factors of poor sleep within or target users to be:

- Technology Use Before Bed
- Stress and Cognitive Overload
- Irregular Sleep Schedules
- Behavior/Perception and Sleep Hygiene
- Environmental and Physical Sleep Conditions
- Napping as a Sleep Management Strategy

From these pervasive problems, while distinct and to a much lesser degree are a subset of problems experienced by those with insomnia. This led the team to continue in the direction of an accessible CBT-I solution offered through a mobile application. From this we broke down the core components of existing CBT-I solutions and based on our academic and user research modified these components to adhere to our perceived user needs. The features derived were as follows:

- Sleep Hygiene education
- Auditory Sleep assistance
- Sleep tracking
- Habit Accountability System

Additionally, with excessive phone usage being such a pervasive issue in our problem space the team wanted to help eliminate this factor from the design solution, to do this the team came with the idea of externalizing useful night-time features. Opting to do this in the form of an alarm clock and a wearable as this is required to facilitate intended features, as well as provide a tangible element to our solution to increase self-awareness and accountability (like how the physical presence wearing a fitbit can subconsciously affect a user's behavior when deciding when or when not to exercise). We then broke our features down by day-time features that are intended to be interacted with through the day using the app and night-time features that would need to be integrated into the alarm clock or wearable system allowing them to be used separately during the night.

Mobile App/Day time features:

- Sleep Hygiene education
- Habit accountability system

Alarm Clock + Wearable/Nighttime Features:

- Sleep tracking
- Habit accountability
- Wake up alarm

From the app and alarm clock each with associated features we present the design proposal “CatBT-I” with the cat aspects being added as part of the team's design touch. To come up with a Design Proposal MVP the we wanted to elaborate on why we included each feature based on user research on how an initial implementation of each feature could be composed:

Sleep Hygiene Education:
The feature would provide users with static education and would cover content on sleep hygiene along with anxiety and stress management modules. The content would be offered optionally to the user to be read through within the mobile app. This inclusion is derived primarily from user surveys where it was found that while many people have a cursory knowledge of sleep hygiene it is often not comprehensive. Additionally as anxiety and stress were a frequent disturbance to sleep in the target users the related modules would attempt to offer management techniques for these disturbances.

Sleep Assistance:
These would be offered as Soundscapes allowing the users to customize the chosen soundscape from rain, ocean waves, etc within the app before bedtime. The sound can then be played by pressing a physical button on the alarm clock and plays through integrated speakers. This feature is included as from user interviews many were seen to make use of soundscapes are other auditory stimulation to help dull late night anxiety provoking thoughts.

Sleep Tracking:
One insight that we learned through our research process is that part of having good sleep hygiene is having a consistent sleep schedule. To help our users achieve this habit, we equipped CatBT-I with a sleep tracking feature. Users will be able to track their sleep by either manually entering their sleep time or automatically with the physical wearable device. Users will be able to automatically track their sleep using the wearable device. When the user falls asleep, sensors within the device will start recording the user’s sleep phase including any time the user wakes up in the middle of sleeping. The user will then be able to review how long they sleep and the quality of their sleep after they wake up.

Habit Accountability - 1: Phone Usage Detection - Alerts & Locks:
Throughout numerous studies and research it has been highlighted that late-night phone usage, particularly 1 hour before sleep is seen as majorly detrimental when it comes to sleeping on time. Through the bluetooth connection with the user’s phone, ideally the app and clock would be able to detect phone usage within a certain period leading up to a user's intended sleeping time. Their time period could either be set by themselves, formulated by the app based on their schedule or activated manually.

Throughout this period, whenever the user uses their phone for certain thresholds of time like, 5 minutes, 10 minutes, 15 minutes and so on, a personalized alert, where during initial setup the app would encourage the users to record their own voices and content for, would be sounded from the physical device.

Research looking into the psychology behind this sort of concept suggests that self-relevant messages (like hearing one's own voice or seeing personalized content) are a lot more persuasive than being given something generic and detached due to the self-referencing effect, denoting that individuals are more likely to process, remember, and act on information that directly relates to themselves.

In combination with these alerts, there would also be an app softlock feature that initiates when the user ignores the later phone usage thresholds. This feature would aim to discourage users from accessing apps that they designate through the use of a multistage unlock process.

- When trying to access a designated app, it would prompt a yes/no confirmation
- The user would then have to undergo a short task such as having to type out a series of randomly generated words.
- Upon doing so, it would then prompt a final yes/no confirmation

Disabling the entire soft lock feature itself would also involve a similar process. In general however, this feature aims to utilize the concepts of design-friction, time-delays and micro-boundaries, to reduce users acting upon impulsive phone usage, increase prioritization of timely sleep and prompt reflection.

Habit Accountability - 2: Gamified System:
When looking back on our background research, it is emphasized that poor sleep quality can be and should be mitigated through targeted interventions. The students we are targeting specifically are those who prioritize their other needs over proper sleep, be they social, academic or leisure based. Gamification is already an exceedingly popular strategy when looking at maintaining user consistency and retention across all sorts of literature and domains, so we've decided to integrate aspects of gamification to give users another reason to stay on track via the providing of rewards, positive reinforcement and tangible progress.

How the system would work is that users would essentially be able to earn an in-app currency to spend on unique game-like customizations and unlocks, adding an aspect of personalization and attachment to the experience.

The currency would be earned through actions such as

- Having sleep and wake up times logged
- Writing sleep journal entries
- Completing short educational modules
- Achieving sleep goals formulated from their sleep data
- Using their phones less at night
- Just generally engaging with the concepts the app is trying to endorse, and maintaining them.

These customizations and unlocks would come in the form of purchasing different facets of themes such as:

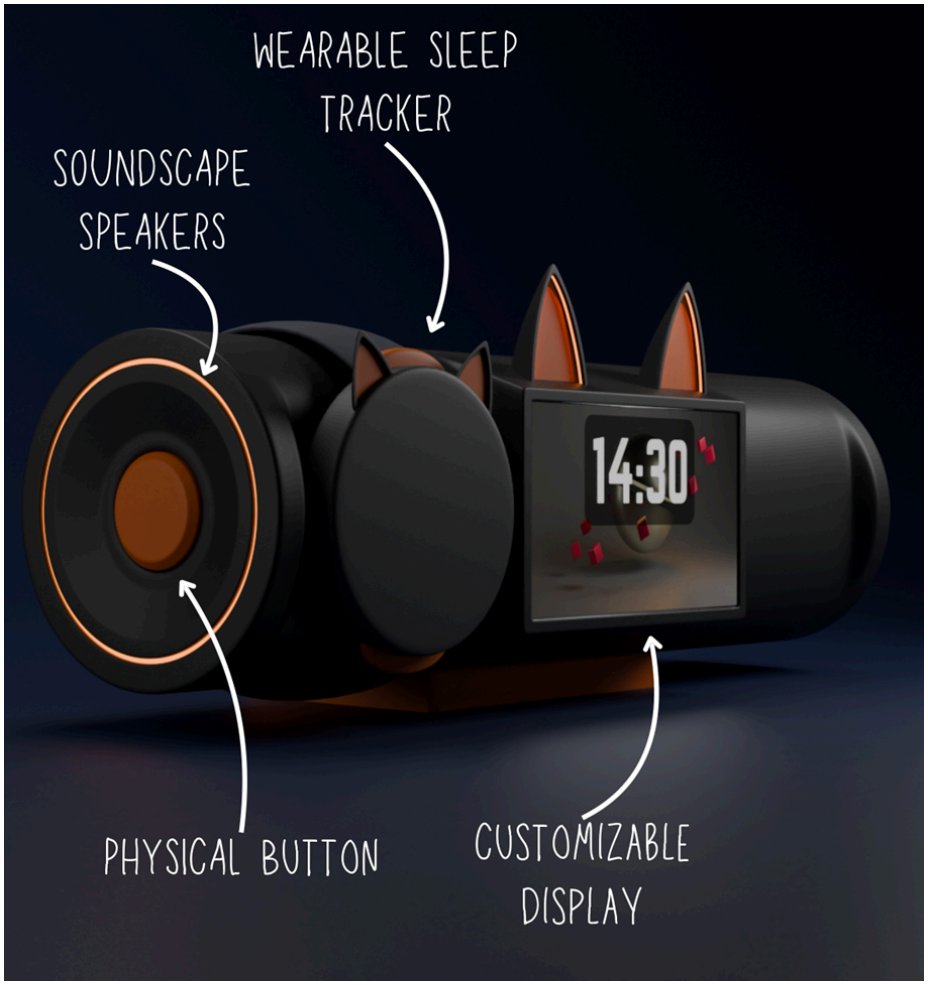
- Visual and interface customizations for the app
- Digital display customizations for the clock
- Alarm tones
- Soundscapes

Wake up Alarm

This would be a regular wake alarm making use of configured time and sound. Although not directly studied it is assumed many users make use of their phone for wake up alarms. As the idea behind the cat clock is to allow the user to remove the presence of their phone during sleep this feature was seen as essential in facilitating this idea.

6.4 Visual Design

Team designed a visual design of the presented ideas and may be integrated into an alarm clock shown in the figure below:



6.5 User Personas and Storyboard

Two user personas were created in order to represent users that would benefit from the use of CatBT-I.

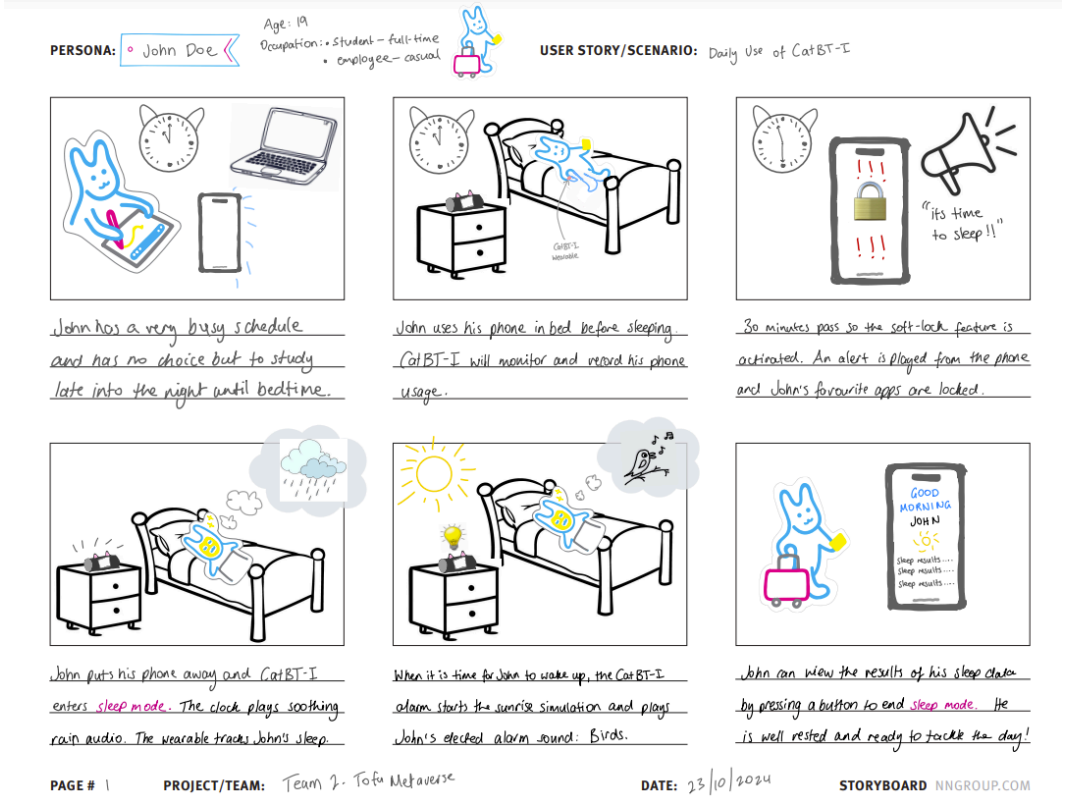
Max Chen is an 18 year old university student:

- Max often spends her evenings in bed browsing social media or watching content on streaming services on her smartphone or laptop
- She often studies late at night
- Her sleep schedule is highly irregular, varying by several hours each night
- She has trouble falling asleep, feels fatigued during the day, and has trouble concentrating in class

Rocky Lorry is a 19 year old university student:

- Rocky lives with two roommates in a busy apartment complex
- He works part-time at a technology store
- He loves online games, and often plays video games with his friends at night
- As a result, his sleep schedule is irregular and he often drinks energy drinks during the day to stay feeling alert
- Lately, he has noticed that his academic performance has declined, he often feels tired, and he has frequent headaches

The following storyboard visually outlines a scenario in which the CatBT-I is used, and how it may help users like Max and Lorry.



7.0 Ethical Considerations:

Feedback Incorporation: *Part of the feedback received in regards to Ethical consideration was the previous focus on Universal Usability practices, these have since been annexed to appendix 11.8 as an aside with more focus placed on the remaining sections. Additionally we received feedback to include stakeholder specific considerations and how our design might uniquely affect our stakeholders, this has been included as 7.3 which specifically focuses on how our design might affect first and second year students.*

Ethical Considerations have been considered in three aspects, the first are the universal ethical design considerations, these are not project specific and have been included as a brief aside in appendix 12.8. The second relates to user research and how the team has adhered to ethical engagements with users through this research, and the final section are ethical considerations related to the proposed design and specific considerations that should be accounted for when developing the design.

7.1 Ethical Engagement

Surveys and interviews were conducted ethically by first formulating a procedure to conduct the user research which included obtaining interviewee/surveyee consent for the collection and use of the gathered data along with anonymization of data after collection.

Sleep diary data was the most invasive form of user research and for this reason was chosen to be done auto ethnographically within the team, this was done to limit ethical concerns with each team member acknowledging the use and purpose of this data and is in a position to raise any concerns.

7.2 Design Ideas Ethical Considerations

CatBT-I is not a CBT-I Solution

From a broad perspective part of our solution is to offer an accessible version of a CBT-I solution, a solution designed for those with insomnia. However we are notably not a fully fledged CBT-I solution and only offer a subset of the features and measures of these holistic solutions. Given that the proposed solution name is a take on CBT-I this introduces the ethical concern of: If not made clear the app is not a CBT-I solution it could be mistaken as a full implementation of CBT-I and maybe be used by users who suffer from more severe sleeping conditions.

Education should not replace Professional Help

Part of our app is to offer users with both sleep hygiene education and anxiety and stress management education. Both of these topics are not necessarily black and white and each individual user may have many nuances when it comes to implementing habit changes, additional mental health can be an extremely complicated subject with many contributing factors and it would be extreme to assume that education modules alone can make meaningful change in a users mental health. These reasons introduce the ethical concern of providing inadequate solutions to a user's problem, and therefore any included content should not be marketed as a substitute for professional advice and help.

Consequences of Sleep Assistance Audio
While many users benefit from the use of sleep audio it is not uncommon for these to have adverse effects. This can primarily in the cases of poor audio quality or issues with sound files. If audio quality is choppy or distorted this may have the effect of making it harder to fall asleep. While in most cases this concern is not severe, there should be adequate quality assurance and testing to validate speaks and any included audio files.

Ethical Sleep Tracking
Some users may not want big tech not to know when they are falling asleep due to concerns that future singularity will use this information to plan out its forceful takeover of humanity (The team is not personally worried about such concerns and welcome the inevitable AI overlords), or because they feel the tracking data is unreliable for them. Due to such concerns users should be given alternative methods of tracking their sleep such as through the use of manual entry.

Phone usage Detection Alerts and Locks:
Part of the habit accountability system is in regards to a physical device that alerts the user using their own (or their fathers) voice, this is an idea that ventures into a more strange territory of design. One concern could be that some users are not comfortable being disciplined by their own voice, and this drives them away from the device's functionality.

The second part of the habit accountability system is the app soft locks. This type of functionality of limiting the usage of other applications must recognise when a user should be able to bypass these features, such as in an emergency. It is important that a mechanism is designed into the application that will allow the user to ultimately stop the functionality.

Gamified System:
When introducing gamified systems into design it is important to be mindful that you are actually incentivising the behavior you are trying to encourage. In many cases introducing even artificial rewards for tasks does not necessarily encourage the expected behavior and in the worst case may even encourage worse behavior, for example if a system rewards players for waking up at a certain time then if a user falls asleep much later than expected they set an alarm to wake up to receive the reward and then simply go back to bed, in this example all the reward has done is interrupt the users sleep, and this type of behavior of “gaming a system” should not be unexpected and unaccounted for. Therefore this introduces the ethical concern of having to be careful about how reward structures are incentivised to not unintentionally worsen user behavior.

7.3 Ethics in Regards to Stakeholders

Along with Design specific ethical considerations we also have stakeholder specific considerations:

First and Second Year Participation in Nighttime Events:
For some a large part of university socialization occurs on nights out and participation in parties. While our solution should encourage beneficial sleep habits there is also the consideration of the benefit of these nighttime socialization events and therefore this raises the ethical consideration of when it is worth participating in these social events vs getting a good night's sleep. And ultimately this decision should be made by the user, therefore the design should not be overly bearing on a user's sleep and should cater for these occasional activities.

Accessibility:
With the inclusion of both an Alarm clock and Wearable the proposed design is less accessible then initially intended, this raises the ethical consideration of accessibility within our target audience and if the proposed solution really is accessible to university students given the possibly high price point.

Possibility for Distraction:
Given the nature of university study, much of the study is self driven. This becomes an ethical concern with the inclusion of a gamified system as this could result in the implemented system offering more of a distraction to first and second years students throughout the day possibly outweighing the benefits of improved sleep quality. This consideration should be accounted for by having the gamified system act passively to the users life and not encourage constant engagement.

8.0 Questions/areas of Investigation

Within the design proposal the ideas discussed are strongly supported by both user and academic research as this has been the primary focus of the groups design activities. Additionally many of the incorporated design ideas have seen substantial effective implementation and use in existing systems. However due to the nature of making use of existing ideas it leaves questions about our design specific decisions.

Firstly the design is notably strongly inspired by the effectiveness of existing technology primarily CBT-I however current CBT-I offer accountability through sleep coaches, while the proposed solution offers a more passive approach through the use of alerts and a gamified system. This incorporation of technology has not been rigorously tested and the specifics of how a user should interact with such a system is still an untested question that remains to be answered through further MVP testing.

The second notable area of investigation is in regards to the proposed alarm clock and wearable. While these are theoretically designed to eliminate distraction and build a “sleep environment” for the user, these ideas have not been seen in past solutions with the effectiveness and value to users being unknown. This area of the design has many questions that should be invested such as:

- Do users want an externalized device in place of a phone
- Do users want an dedicated wearable purly for sleeping
- What metrics should a dedicated wearable track and what technology is required to track these metrics
- Does this combination of alarm clock and wearable actually replace the requirement for a phone while sleeping? (e.g many users may want their phone next to them for an unaccounted reasons)
- What is the expected cost of producing such technology

The final question relates to the solution as a whole, while the individual components may be individually justified that does not inherently mean the proposed design is cohesive and as a whole provides values to users. This is a broad question requiring an implementation of an MVP to gauge user reaction and outcomes to the solution as a whole..

9.0 Team reflection:

9.1 Project direction and focus

Since deciding on our initial domain, our team has always had a firm grasp of our overarching problem we’d eventually want to try and solve. Even before doing any research, we’d known that there was a common stigma surrounding the “common university student”, sacrificing sleep for uni work and the balancing of their lives.

We went into the problem identification milestone trying to gain a very broad understanding of why lack of sleep was a problem to university students in particular, trying to find out relevant relationships and patterns. Our whole approach to doing this subsisted around splitting the team into half; half doing user research via interviews to gain insights into the causes; half doing background and literature research.

From doing this we were able to gain a foothold into the domain itself. While our research was very honed in what knowledge and patterns it provided, our academic research was very disjoined and sparse in terms of focus. Mainly it consisted of looking at studies based on some keywords we’d identified and listing the findings down. We never really got to a point before submitting our report, to where we cohesively stitched together and combined these findings into a chain of logic we could use to support the rest of our decision. This impacted us in that we didn’t have an entirely solid foundation to which to base our overall decisions and line of thinking, and as such we were somewhat unfocused in what we exactly knew and needed to know to continue onwards towards refining our report.

From then establishing a knowledge base (regarding the causes of sleep deprivation in university students and the various associated relationships) to draw from became an important factor for improvement, to which we eventually did try to do for milestone 2. We had also attempted to incorporate more user research to support our findings as well as grasp at any other alternative insights, but we at least achieved our goal to an extent, of narrowing down target areas for a solution.

For Milestone 3, our main goal was to synthesize a concrete solution out of the design directions we had considered previously. Initially we had a few design ideas which we viewed in a rather mutually exclusive fashion, however when coming together to actively think about and recap for ourselves the key takeaways and patterns from our overall findings, many aspects of these directions could be taken out and integrated into one larger design that still had the ability to provide the benefits they had when isolated. Leading us to our final solution and having achieved our goal of coming to a design consensus.

9.2 Teamwork process and collaboration

Our team hasn't officially adopted any standard design process, but if we were to liken what we've done to anything it would lean more towards being "Incremental" or "Agile".

What we'd do was meet every Monday, detail out what we'd need to accomplish as a whole e.g. do user research, do academic research, work on the report, etc, and then break it down into individual tasks that we'd delegate to each person in the team.

From then on that person would work towards that goal, and during our Wednesday class, we'd catch up on progress or affirm what needed doing, and continue on until the next week to where we'd have another meeting about what would need to be done.

The only downside to this however is that we really only delegated these short timeframes (1 hour roughly) to really thinking about what we'd need to accomplish next as a group, which leaves much to be desired when trying to figure out a solid and airtight plan of action, especially when factoring in the timeframes we need to get work done in.

Other than that we'd also use Discord to communicate amongst one another if there were any other outstanding questions, but thus far we haven't had too much overlap between one another when working on our respectively assigned tasks (which might have lead to some disjointedness in what we all know cohesively as a team).

Our final stretch for writing the report of milestone 3 highlighted difficulties in sticking to the process we were taking previously, as many of the team members had a number of other responsibilities which kept them away from meeting or working on the project. The teamwork and cohesiveness displayed in this final stretch suffered heavily from a lack of organization because of this and should have been handled better, via all the team members effectively communicating their availability and timelines more.

10.0 References

Ali, R. M., Zolezzi, M., Awaisu, A., & Eltorki, Y. (2023). Sleep quality and sleep hygiene behaviours among university students in qatar. International Journal of General Medicine, 16, 2427–2439. https://doi.org/10.2147/IJGM.S402399

Ahrberg K, D. M. (2012). The interaction between sleep quality and academic performance. *J Psychiatr Res*, 1618–1622.

Apple. (2024, 8 29). *Apple Watch*. From Apple: https://www.apple.com/au/watch/

Asscheman, Y. M. (2024, 1 1). *Ethical Design: Everything You Need to Know*. From UX Testing: https://www.uxtesting.io/blog/76/ethical-design-everything-you-need-to-know

Batten R, L. K. (2020). Cross-Sectional Survey of Sleep Practices of Australian University Students. *Nat Sci Sleep*, 12:39-48.

Black Dog Institute. (2024, 8 29). *Sleep Ninja*. From blackdoginstitute: https://www.blackdoginstitute.org.au/resources-support/digital-tools-apps/sleep-ninja/

Buysse,D.J., Reynolds,C.F., Monk,T.H., Berman,S.R., & Kupfer,D.J. (1989). The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice. Psychiatry Research, 28(2), 193-213.

Dagfinrud, S. R. (2024, 1 1). *A code of design*. From codeofdesign: https://codeofdesign.org/

Experience calm. (n.d.). Retrieved 8 October 2024, from https://www.calm.com/

Falbe, T. (2018, 3 16). *Ethical Design: The Practical Getting-Started Guide*. From smashingmagazine: https://www.smashingmagazine.com/2018/03/ethical-design-practical-getting-started-guide/#:~:text=Ethical%20Design-,%23,-Let%E2%80%99s%20start%20with

Feifei Wang, É. B. (2021). Determinants of sleep quality in college students: A literature review,. *EXPLORE*, 170-177.

Gallego-Gómez, J. G.-M.-M. (2021). Relationship between sleep habits and academic performance in university Nursing students. *BMC Nurs 20*, 100.

Gallego-Gómez, J. G.-M.-M. (2021). Relationship between sleep habits and academic performance in university Nursing students. *BMC Nurs 20*, 100.

Goldstein, A. N. (2014). The role of sleep in emotional brain function. *Annual review of clinical psychology*, 679–708.

Hannah G. Lund, B. D. (2010). Sleep Patterns and Predictors of Disturbed Sleep in a Large Population of College Students,. *Journal of Adolescent Health,*, 124-132.

Hershner, S. D., & Chervin, R. D. (2014). Causes and consequences of sleepiness among college students. Nature and Science of Sleep, 6, 73–84. https://doi.org/10.2147/NSS.S62907

Hirotsu, C. T. (2015). Interactions between sleep, stress, and metabolism: From physiological to pathological conditions. *Sleep science (Sao Paulo, Brazil)*, 143–152.

How to get a great nap. (n.d.). Mayo Clinic. Retrieved 8 October 2024, from https://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/napping/art-20048319

Insomnia cbt | learn how to sleep again | stellar sleep. (n.d.). Retrieved 8 October 2024, from https://stellarsleep.com/

Kroese, F. M., De Ridder, D. T. D., Evers, C., & Adriaanse, M. A. (2014). Bedtime procrastination: Introducing a new area of procrastination. Frontiers in Psychology, 5. https://doi.org/10.3389/fpsyg.2014.00611

Kudrnáčová, M. &. (2023). Better sleep, better life? testing the role of sleep on quality of life. *PloS on*, 18.

Lovato, N., Lack, L., & Wright, H. (2014). The napping behaviour of australian university students. PLOS ONE, 9(11), e113666. https://doi.org/10.1371/journal.pone.0113666

Mesquita, G., & Reimão, R. (2010). Quality of sleep among university students: Effects of nighttime computer and television use. Arquivos de Neuro-Psiquiatria, 68, 720–725. https://doi.org/10.1590/S0004-282X2010000500009

Muse™ eeg-powered meditation & sleep headband. (2024). https://choosemuse.com/, https://choosemuse.com/

Okano, K. K. (2019). Sleep quality, duration, and consistency are associated with better academic performance in college students. *NPJ science of learning*, 16.

Rise. (n.d.). Retrieved 8 October 2024, from https://web.risescience.com/offer/sf

Samantha M. Riedy, M. G. (2021). Noise as a sleep aid: A systematic review. *Sleep Medicine Reviews*, 101385.

Sleepon. (n.d.). SLEEPON. Retrieved 8 October 2024, from https://www.sleepon.us/

Seun-Fadipe CT, M. K. (2017). Sleep quality and psychological distress among undergraduate students of a Nigerian university. *Sleep Health*, 190-194.

Takahashi, M. (2003). The role of prescribed napping in sleep medicine. Sleep Medicine Reviews, 7(3), 227–235. https://doi.org/10.1053/smrv.2002.0241

The sleep ninja app. (n.d.). Black Dog Institute | Better Mental Health. Retrieved 8 October 2024, from https://www.blackdoginstitute.org.au/research-projects/sleep-ninja/

Trockel, M., Manber, R., Chang, V., Thurston, A., & Tailor, C. B. (2011). An e-mail delivered cbt for sleep-health program for college students: Effects on sleep quality and depression symptoms. Journal of Clinical Sleep Medicine : JCSM : Official Publication of the American Academy of Sleep Medicine, 7(3), 276–281. https://doi.org/10.5664/JCSM.1072

Toscano-Hermoso MD, A. F.-O.-S.-F. (2020). Influence of Sleeping Patterns in Health and Academic Performance Among University Students. *International Journal of Environmental Research and Public Health.* , 2760.

Qiu, C., Yu, Y., Cheema, A., Harvey, C.-J., & Morrell, M. (2019). P009 The need to educate university students about sleep. BMJ Open Respiratory Research, 6(Suppl 1). https://doi.org/10.1136/bmjresp-2019-bssconf.9

Yeluri, K., Hs, K., H, B. G., & Bj, S. C. (2021). Electronic gadget screen-time, perceived sleep quality & quantity and academic performance in medical students. The Journal of the Association of Physicians of India, 69(11), 11–12.

Mayo Clinic. (c2024). *Napping: Do's and don'ts for healthy adults*. https://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/napping/art-20048319#:~:text=Napping%20can%20also%20have%20negative,waking%20up%20from%20a%20nap

Trockel, M., et al. (2011). An e-mail delivered CBT for sleep-health program for college students: Effects on sleep quality and depression symptoms. *Journal of Clinical Sleep Medicine, 7*(3), 276–281. https://doi.org/10.5664/JCSM.1072

11.0 Appendix

11.1 Interview Protocol

Introductory Questions

1. How old are you?
2. What do you study in university?
3. Do you think you get enough sleep?
4. What else do you do outside of university?

Questions about sleep

1. Describe your current sleeping schedule.
    1. Time wake up/time sleep
    2. Use phone before bed?
    3. What conditions (lights, etc)
2. How long roughly does it take you to fall asleep?
3. Do you wake up tired from sleep? (Quality of sleep)
4. Do you frequently wake up during the night?
5. Are you happy with it? If not, what would you change? Describe your ideal sleeping schedule.
6. What are the main factors that prevent you from maintaining your ideal schedule? Is there anything specific that make you stay up late?
7. Has there been a time where you have ruined your sleep schedule? How/for how long did it effect you (mood, energy levels etc.)? How did you recover from it?

Question about lifestyle?

1. Do you often feel tired?
2. Do you have trouble waking up early?

Questions about solutions

1. What are some things you do to help with maintaining sleep schedule?
2. What are some things that you think may help you sleep better?

Ask additional questions where relevant
Try to have a diverse interviewee base

11.2 Interview Transcripts

Interview 1

Speaker 1:
Yo, Speaker 2! What's up, man? How's life treating you? Ekka is coming, any plan for it?
Speaker 2:
Haha, Life's alright, just trying to survive university. My friends call me to the Ekka tomorrow, but not interested.
Speaker 1:
Same here, just trying to stay awake long enough to ask you a few questions.
Speaker 2: Oh, Uq ask for it ? Shall we talk in English?
Speaker 1: Na, it doesn't matter, I will translate it and write a transcript.
Speaker 2: OK, what you wanna ask.
Speaker 1: how old are you now? Like, 40?
Speaker 2:
Ha! Not quite. I'm 21, thank you very much. Just a young buck compared to you.
Speaker 1:
And what's the latest? Still majoring in Psychology, or have you decided to become a professional napper?
Speaker 2:
Oh, definitely sticking with Psychology, but professional napping sounds like a solid backup plan. Maybe it'll help me understand why I never get enough sleep!
Speaker 1:
Dude, I hear you. Do you even sleep, or do you just close your eyes and think about all the assignments you've got to finish?
Speaker 2:
Pretty much! I try to sleep, but my brain's like, 'Nah, let's think about that awkward thing you said five years ago instead.'
Speaker 1:
Classic! So what do you do when you're not pretending to sleep? Any wild hobbies?
Speaker 2:
Well, when I'm not at the gym trying to convince myself I like exercise, I'm either reading recipes or cooking. You know it, we both like cooking
Speaker 1:
Alright, real talk—what's your sleep schedule like? Or should I ask, do you even have one?
Speaker 2:
I try to go to bed around midnight and wake up at 7:30 AM, but honestly, it's more like midnight-ish to whenever my alarm decides to yell at me.
Speaker 1:
And please tell me you're not through your phone away before bed.
Speaker 2:
Uh, yeah… totally not. Except for when I do. Which is every night. Social media's just too good at keeping me up!

Speaker 1:
Right? It's like, 'I'm going to sleep,' and then bam! It's 2 AM.
Speaker 2:
Exactly! And then I wonder why I'm so tired the next day.
Speaker 1:
So, what's the sleep vibe? Lights out, or do you prefer that cozy, half-light thing?
Speaker 2:
Definitely lights out. But sometimes the streetlight outside is like, 'Hey, I'm gonna join you!'
Speaker 1:
Ugh, classic streetlight crashing the party. How long does it take you to actually fall asleep once you put the phone down?
Speaker 2:
On a good night, like 20 minutes. On a bad night, I'm up solving the world's problems for a solid hour.
Speaker 1:
And then you wake up like, 'Why do I feel like a zombie?' How's the quality of your sleep, though?
Speaker 2:
Well, let's just say I'm not winning any 'Well-Rested' awards. I'm basically the poster child for tired.
Speaker 1:
Do you wake up in the middle of the night, or are you a solid sleeper once you're out?
Speaker 2:
Mostly solid, but sometimes I wake up because my brain's like, 'Hey, did you forget to do that thing?'
Speaker 1:
Ugh, that's the worst! So, are you happy with this sleep situation, or are you dreaming of a better one—pun intended?
Speaker 2:
Ha! Definitely dreaming of a better one. Ideally, I'd be in bed by 10:30 PM and up at 6:30 AM, all bright-eyed and bushy-tailed. But who am I kidding?
Speaker 1:
What's holding you back?
Speaker 2:
late nights, social events, and my binge-watching habits don't exactly help.
Speaker 1:
Has there ever been a time when your sleep schedule was totally wrecked? Like, how bad was it?
Speaker 2:
Oh, finals week was a nightmare! I was sleeping at crazy hours, and it turned me into a grumpy, caffeine-fueled mess. Took me weeks to recover!
Speaker 1:
Yikes! Been there, done that, got the dark circles. So, do you often feel like you're running on empty?

Speaker 2:
All the time! Especially in the afternoons when I feel like I could just curl up under my desk and take a nap.
Speaker 1:
Do you have any tricks to keep your sleep on track?
Speaker 2:
Well, I try to avoid caffeine late in the day, and I've been doing some light stretching before bed. I also try—keyword: try—to put the phone away early.
Speaker 1:
And if you could magically improve your sleep, what would you do?
Speaker 2:
I'd definitely stick to a routine, maybe get one of those fancy white noise machines, and train myself to stop thinking about everything before bed!
Speaker 1:
Sounds like a plan! Alright, I'll let you get back to whatever it is you do when you're not chatting with me. Thanks for the laughs.
Speaker 1: do you think students like us came far away from home will have more stress than local students? So we much easier to be stressful, that will influence our sleep quality?
Speaker 2: will, I'm can't tell, but if my family is here, I can pay less tuition fee than international students, no culture shock, and I won't worry about fucked up with my GPA then go back to Malaysia with nothing. Yeah, I can have more good nights.
Speaker 1: dude..haha
Speaker 2:
Haha, I will find a time to call you for coffee. Next week.
Speaker 1:
yeah, we haven't met for two weeks, busy. Thanks by the way.

Interview 2

Speaker 1: Hi, Speaker 2. Thanks for taking the time to talk with me today. Could you start by telling me how old you are?
Speaker 2: Hi, Speaker 1. Sure, I'm 20 years old.
Speaker 1: Great, and what do you study at university?
Speaker 2: I'm studying psychology. It's really interesting to learn how the mind works.
Speaker 1: That sounds fascinating. Do you think you get enough sleep?
Speaker 2: I try to, but sometimes it can be a bit tricky with all the assignments and studying.
Speaker 1: What else do you do outside of university?
Speaker 2: I like to spend time with my family and friends. I also do some volunteering work and occasionally play some sports.
Speaker 1: Let's talk a bit more about your sleep. Can you describe your current sleeping schedule?
Speaker 2: I usually go to bed around 11 PM and wake up at 7 AM, so I get about 8 hours of sleep. Sometimes I stay up a bit later if I'm studying or watching something, but I try to stick to that schedule.
Speaker 1: Do you use your phone before bed?
Speaker 2: Yeah, I do. I often scroll through social media or watch some videos before I fall asleep. I know it's not the best habit, but it helps me wind down.
Speaker 1: What's the environment like when you're trying to sleep? Do you keep the lights on or off?
Speaker 2: I like to keep the lights off, but I usually have a small nightlight on. I also try to keep the room cool and quiet, which helps me relax.
Speaker 1: How long does it usually take you to fall asleep?
Speaker 2: On most nights, it takes me about 15 to 20 minutes to fall asleep. If I've had a busy day, it might take a bit longer.
Speaker 1: Do you wake up feeling tired, or do you feel rested?
Speaker 2: I usually wake up feeling pretty rested. If I've had a stressful day or stayed up too late, I might feel a bit tired, but overall, I think my sleep quality is good.
Speaker 1: Do you frequently wake up during the night?
Speaker 2: Not really. I usually sleep through the night unless something wakes me up, like a noise or if I'm feeling stressed.
Speaker 1: Are you happy with your sleep schedule? If not, what would you change?
Speaker 2: I'm mostly happy with it. I think if I could change anything, I'd try to use my phone less before bed and maybe go to sleep a bit earlier.
Speaker 1: What are the main factors that prevent you from maintaining your ideal schedule? Is there anything specific that makes you stay up late?
Speaker 2: The main thing that keeps me up late is usually studying or if I get caught up in watching something online. Sometimes it's just hard to put the phone down.
Speaker 1: Has there been a time where you've ruined your sleep schedule? How did it affect you?
Speaker 2: Yeah, there was a time during finals last semester where I was staying up really late to study. It definitely affected my mood and energy levels—I was more irritable and felt drained. It took a few days after exams to get back to my normal routine.

Speaker 1: Do you often feel tired?
Speaker 2: Not often. I think because I'm living at home with my family in Brisbane, I don't have to worry about things like rent or living costs, which takes a lot of stress off me. My parents help out a lot, so I can focus more on my studies and staying healthy.
Speaker 1: Do you have trouble waking up early?
Speaker 2: Not really. Since I don't have to worry about managing a household or anything, it's easier for me to get up early and start my day.
Speaker 1: What are some things you do to help maintain your sleep schedule?
Speaker 2: I try to stick to a regular routine, even on weekends. I also make sure my room is comfortable for sleeping and avoid having caffeine too late in the day.
Speaker 1: What are some things that you think might help you sleep better?
Speaker 2: I think using my phone less before bed would help, and maybe trying some relaxation techniques like deep breathing or meditation before going to sleep.
Speaker 1: Thanks for sharing all that, Speaker 2. It sounds like you have a pretty balanced lifestyle, which is great.
Speaker 2: Thanks, Speaker 1! I'm really grateful for the support I have from my family—it definitely makes things easier.
Speaker 1: Let's dive into your sleep schedule. Can you describe your current sleeping habits?
Speaker 2: My sleep schedule is pretty flexible. I usually go to bed around 11 PM, but there are nights when I stay up until 3 or 4 AM, especially if I'm on my phone or watching something interesting. If I stay up that late, I'll skip my 8:00 AM class to get more sleep and wake up naturally.
Speaker 1: Do you use your phone before bed?
Speaker 2: Yeah, I use my phone a lot before bed. Sometimes I lose track of time scrolling through social media or watching videos, which is why I end up staying up so late.
Speaker 1: What's the environment like when you're trying to sleep? Do you keep the lights on or off?
Speaker 2: I prefer to keep the lights off, but I usually have a small nightlight on. My room is pretty quiet, and I like it to be cool, which helps me relax.
Speaker 1: How long does it usually take you to fall asleep?
Speaker 2: If I go to bed at a reasonable hour, it takes me about 15 to 20 minutes to fall asleep. But if I've been on my phone a lot, it can take longer.
Speaker 1: Do you wake up feeling tired, or do you feel rested?
Speaker 2: If I've stayed up until 3 or 4 AM, I usually feel tired the next day. But if I sleep in and wake up naturally, I feel pretty rested.
Speaker 1: Do you frequently wake up during the night?
Speaker 2: Not usually. I tend to sleep through the night unless something wakes me up, like a noise or if I'm feeling stressed.
Speaker 1: Are you happy with your sleep schedule? If not, what would you change?
Speaker 2: I'm okay with it, but I know I could probably get more consistent sleep if I went to bed earlier. I should probably cut back on using my phone before bed, but I don't worry too much about it since I can adjust my schedule and sleep in if I need to.
Speaker 1: What are the main factors that prevent you from maintaining an ideal schedule? Is there anything specific that makes you stay up late?

Speaker 2: The main thing is definitely my phone. I get caught up in social media or watching videos, and before I know it, it's really late.
Speaker 1: Has there been a time where you've ruined your sleep schedule? How did it affect you?
Speaker 2: During finals, I stayed up late a lot, which definitely messed up my sleep schedule. I was more tired and irritable, but I bounced back pretty quickly once the exams were over.
Speaker 1: Do you often feel tired?
Speaker 2: Not too often. I think living at home with my family in Brisbane helps a lot. I don't have to worry about rent or living costs, so that reduces a lot of stress. My parents cover most of my expenses, so I can focus on my studies and keep a pretty relaxed lifestyle.
Speaker 1: Do you have trouble waking up early?
Speaker 2: I wouldn't say I have trouble, but I don't usually wake up early unless I need to. If I've stayed up late, I'll just sleep in and skip an early class if I need to.
Speaker 1: What are some things you do to help maintain your sleep schedule?
Speaker 2: I try to stick to a routine, but it's pretty flexible. I make sure my room is comfortable and avoid caffeine late in the day. If I know I've stayed up too late, I'll let myself sleep in the next morning.
Speaker 1: What are some things that you think might help you sleep better?
Speaker 2: Probably cutting back on my phone use before bed and maybe trying to set a more consistent bedtime. But honestly, I'm not too stressed about it since I can adjust my schedule as needed.
Speaker 1: Thanks for sharing all that, Speaker 2. It sounds like you have a good balance in your life.
Speaker 2: Thanks, Speaker 1! I'm really grateful for the support I have from my family—it definitely makes things easier for me.

Interview 3

Speaker 2
OK, this is an interview for Deco 3800 design proposal. Do you consent to your answers being used in the research for our design proposal?
Speaker 1
Yes, I consent.
Speaker 2
Thank you. How old are you and? What do you study?
Speaker 1
I'm 21 years old and I study commerce and IT dual degree.
Speaker 2
Thank you. Do you think you get enough sleep?
Speaker 1
Yes.
Speaker 2
OK. And what kind of other things do you do outside of university?
Speaker 1

I work. A lot
Speaker 2
Anything else?
Speaker 1
In terms of activities and hobbies, or?
Speaker 2
Yeah, basically things that that you think take up a significant amount of time.
Speaker 1
My work takes up a lot of it and I'm on my phone for the rest of it. I occasionally, Jim, but I wouldn't say that's the majority of my time.
Speaker 2
Ohh and and yeah. Sister, right. Who you also take care of.
Speaker 1
Right now my, my mum and dad are both here, so my dad is doing most of the caring right now. Hence why I can work more.
Speaker 2
OK. Can you describe your current sleeping schedule for me? So things like time that you wake up time, that you go to sleep and just overall pattern of your.
Speaker 1
Sleep. So it has stayed mostly consistent for the past few weeks. I try to go to sleep around 12 and wake up around 7:30, but I end up waking up like 729 to turn off the alarm and sleep till. 8. So I get a pretty decent amount of sleep because all my classes are planned. Like fairly late into the day and my dad is here to send my sister to school so I don't need to worry about that. Otherwise, normally I'd have to wake up fairly early, around 7:00 to. Wait for. Wait for my sister to get ready and send. Her. To school. So right now I do get like between 7:00 and 8:00 hours of. Sleep, yeah.
Speaker 2
OK. Thank you. Do you use your phone before bed?
Speaker 1
Most definitely an obscene amount my. From my screen time goes from one day to the next, my screen time begins with 30 minutes already done for the day.
Speaker 2
Oh.
Speaker 1
It's bad well.
Speaker 2
So so when you say you go to sleep at around 12, is that you falling asleep at 12 or you getting in bed?
Speaker 1
At 12, I guess this is where it's inconsistent. Sometimes I just go into bed earlier than 12, but I try my best to close my eyes around 12. I can try.
Speaker
Hmm.
Speaker 2

OK. And what kind of conditions do you sleep in? Like, is it pitch black or yeah, what kind?
Speaker 1
Of conditions. So sometimes the moon is a bit bright and like blinds don't shut fully. So I guess that'll depend, but usually I turn off all my lights or I always turn off. All. My lights and go to sleep. As as dark as I can of A room.
Speaker 2
OK. And can you estimate roughly how long it takes you to fall asleep from the moment you close your eyes until falling asleep?
Speaker 1
I do realise that sometimes if I'm more tired I can almost it feels like go to sleep instantly. Otherwise, if I'm on my phone for a while and I feel a bit drowsy, I put my phone down and it's almost instant. Well, but if I try to force myself to sleep, I'm not too sure. I've never checked. I just close my eyes and try. Not to open.
Speaker 2
Right. So so you have times where you know you're going to fall asleep really fast and then other times like you kind of have to convince yourself to fall asleep. Is that right?
Speaker 1
Yeah, like if I if I know I have to do something early in the morning, I try force myself to go to sleep before, like, the 12:00 that I. Usually plan, yeah.
Speaker 2
Do you find yourself waking up tired often?
Speaker 1
Surprisingly not. I used to when my sleep schedule was an absolute mess, but right now it's not that bad. Yeah, by by absolute mess, I mean, I didn't look at the time when I went to sleep. I didn't look at the time when I went, woke up, and usually always under 8 hours of sleep. Yeah. But now it's fine.
Speaker 2
OK, so if you if you feel OK, when you wake up, do you think that? It's cause you're getting good quality sleep.
Speaker 1
UM. The initial moments when I wake up, I guess it. Is. Because I feel I got enough sleep, but sometimes during the day I'm still forgetful. There's still, like the old habits. I don't know if that's sleep related or not, but. From thence, when I wake up, I feel like I can get out of bed if I wanted to, which is what I usually do for work, but if not, I might go on my phone for a bit.
Speaker 2
And do you wake up at all during the night?
Speaker 1
No, no, only only for toilet breaks.
Speaker 2
OK. Are you happy with your sleep schedule?
Speaker 1
Mostly yes.
Speaker 2
Is there anything that you would change about it?

Speaker 1
Not being able to sleep would be preferable, but because that would be more productive. However, I understand it is necessary that is why I've changed it.
Speaker 2
So would you say that your sleep schedule now is? Ideal or close to ideal or like can you see it improving? Further.
Speaker 1
It is close to my ideal, but since a lot of other things happened way early in the morning, I guess I would like to try to wake up earlier and most likely fall asleep earlier as well. So I guess my ideal would be. Wake up sometime around 5:00 to 6:00. So I'll see what to do in terms of falling.
Speaker 2
Asleep. So. So what would you say is the main factor or factors that are preventing you from having that ideal sleep schedule, like going to sleep earlier and waking up earlier?
Speaker 1
I guess just wanting to do more stuff, I feel I am a bit more. During the night. Excuse me, but I guess the sense of urgency that comes through me at night just makes me want to do more stuff at night and hence sometimes I have to stop myself to force myself to go to sleep.
Speaker 2
Yeah. So would would you in general say that you're a night person if you're more productive at?
Speaker 1
Night. Yeah, most definitely. And especially so closer to assignment times. If if I need to rush something overnight, I might not even sleep. But very, very rare cases.
Speaker 2
OK. Has there ever been a time or multiple times where you've just absolutely ruined your sleep schedule and because you did mention the overnight assignments, how did it affect you? And. For how long did it affect you, and did you recover from it? So so when I say affect you, so things like mood and energy levels and that kind of thing?
Speaker 1
I think energy levels is a major thing, which can be supplemented through coffee, but only to a certain extent. Caffeine, Red Bulls, monsters. It did help me get through, but I think having good sleep schedule is still. Much more desirable than like taking supplements, yeah.
Speaker 2
So. You kind of just recovered from it just by toughing it out and drinking caffeine and then eventually just getting back into the schedule slowly.
Speaker 1
Pretty much yes.
Speaker 2
Yeah. OK, so I'm going to ask you questions about like. Your day to day. So do you feel tired during the day?
Speaker 1
Yeah, sometimes during the day, if there's really nothing going on and my brain has nothing to do, I do feel very tired and yawn and feel drowsy. But if if something happens or have to do something, I'm usually very quick to wake back up. Yeah.

Speaker 2
And so you mentioned before that you don't usually have trouble getting out of bed, so you don't have any. Trouble waking up early, do you?
Speaker 1
UM. Because right now I'm trying to stick to the sleep schedule. I haven't really tried to wake up earlier than I've already set my alarm. So right now, 7730. But if I do need to wake up early again, I'd probably plan that the night before to either go to bed a bit earlier and probably set like five or six alarms for when. I do need to wake up. Yeah.
Speaker 2
And just out of curiosity, do you ever take? Naps.
Speaker 1
Very, very rarely, because I've experimented trying to take naps, I end up feeling way worse than if I were to just get a full night of sleep.
Speaker 2
OK. So what are some things that you do to help maintain your sleep schedule? If, if, and if you can. Think of anything.
Speaker 1
By don't really I've I've just taken the fall asleep naturally. Wake up naturally and I think that helps a lot. And my body's just gotten used to that. And again, like, it automatically wakes up right before the alarm. So I think what I've done so far is alright.
Speaker 2
So would you say like the consistency is what keeps you going? Because like your body is used to it.
Speaker 1
Yeah. The melatonin cycle is like it'll fix itself if you do it for long enough. So I think, yeah, consistency is key.
Speaker 2
And UM. Is there anything you think that would further help you with that like? For example, your desire to wake up earlier and sleep earlier, do you think? Like any tools or methods, would be always help you with that.
Speaker 1
So if all my alarm and self control has. Done wonders for myself, but I can also I'm looking back to when I had a messed up sleep schedule, mainly in high school. It if if something were to do it automatically for me, I guess that'll take my mind. Take stress knowing that it would be done for me and wake myself up, put myself to sleep automatically, but obviously that's ideal and everything comes down to. Self control, yeah.
Speaker 2
Could you elaborate on that a little? So like what exactly would you want to have done automatically?
Speaker 1
So.
Speaker
If.
Speaker 1

In the ideal world, it's like when you go to work. If you go to work, you're told what to do. You do that thing, you go home, you. Don't. Think about it anymore. So if something was to be able to just make that decision for me, I just needed to execute it. Then I. Wouldn't. Care if, like, say, I don't know an app or like a doctor in this case, maybe say, OK, go to sleep at 8 and wake up at six. That is optimal. Do that and stick to it. Turn your brain off and just do it and you'll feel better by the end of it. Something like that.
Speaker 2
OK, so so something to help regulate your cycle like give you advice about what might.
Speaker 1
Yeah, or even something that can, something that can record your sleeping data. Like I know there's, like some watches and whatever to, like, monitor your sleep. But I don't like wearing stuff to bed. Like a watch. It feels uncomfortable. So I.
Speaker 2
Be best for you.
Speaker 1
I don't wanna do that and I don't know if there's any like like body monitor that can do that without making it uncomfortable. But if you were able to track and record your like sleep data and look over it at some point and you can see, oh, I fell asleep really late that day and woke up very early and got no sleep, maybe that's why I feel drowsy, like being able to look into data like that I think would be very useful into either making decisions for yourself or letting the app make. This is for.
Speaker
You.
Speaker 1
Yeah.
Speaker 2
OK. Thanks for the interview. This concludes all the questions. Goodbye.

Interview 4

Speaker 1
OK, we're starting. This is an interview for the Decker 3800 design proposal. Do you consent to your answers being used in the research for our design proposal? Yes, thank you. OK. How old are you and what do you study in university?
Speaker 2
I am 21 years old. I study law and commerce.
Speaker 1
Thank you. And do you think you get enough sleep?
Speaker 2
Yes.
Speaker 1
And what other things do you do outside of university?
Speaker 2
I work part time and I also go to social events occasionally.

Speaker 1
OK. Can you describe your current sleep schedule for me? So what time you wake up, what time you go to sleep?
Speaker 2
I usually sleep around 12:00 AM and I usually wake up around 7:00 to 8:00 AM.
Speaker 1
Do you use your phone before bed?
Speaker 2
I try not to, but yes I do.
Speaker
Aye.
Speaker 1
And what kind of conditions do you sleep in like? Is it pitch? Black or? Not.
Speaker 2
So I do sleep in pitch black. I also need music playing from my phone in order to fall asleep. Well.
Speaker 1
That's a very interesting insight. Is there anything else that you do for your sleep routine to help you fall asleep or have a good night's sleep?
Speaker 2
I do find that I generally have difficulty falling asleep, and so if I do. In certain circumstances, if I especially have trouble falling asleep, then I just try and read a book or I just study a little bit more so that I make myself tired so that I can fall asleep much. Faster.
Speaker
OK.
Speaker 1
And so you said you sometimes have trouble falling asleep, so. On a bad day, how long roughly does it take you to fall asleep?
Speaker 2
On a bad day, it might be. Maybe an hour. It used to be quite bad. It used to be around two to three hours if that. If it was an especially bad day.
Speaker
Oh wow.
Speaker 1
And. Do you know of anything that might have made the change like so? It used to be a lot worse. Is there a reason why it's improved now?
Speaker 2
I think the main reason is consistently waking up around 7:00 or 8:00 AM. It used to be a lot more inconsistent even just last year. But this year I've been waking up a lot more consistently and I think that's helped me have a much better sleep routine and my body's gotten used to sleeping around a consistent time as well.
Speaker 1
And when you wake up in the morning, do you feel?Really tired.
Speaker 2

I think more often than not, I do feel very tired and that does lead me to fall back asleep, which for example, if I'm staying at home then it will lead me to wake up late. But. If it is a day where I need to go to work or I need to go to classes, then I will inevitably get out of bed. But there have occasionally been some days where I feel very, very tired in the morning and I just have to sleep. Until maybe even 11 or 12.
Speaker 1
Do you frequently wake up during the night?
Speaker 2
Lately I have been it has been around 3:00 to 5:00 AM where I wake up suddenly in the night. It used to never happened to me, but recently it has been. I'm not sure why. But fortunately I can just go back to sleep immediately.
Speaker 1
Are you happy with your sleep schedule right now, and is there anything that you would change about it?
Speaker 2
I do recognise that I get a lot more sleep than others, which can be a good thing, but for me personally I am the type of person that has a lot of difficulty. Getting out of bed in the mornings and so this usually leads me. To oversleep quite often, and so I am trying my best not to oversleep. So that's one thing that I'm quite unhappy about, but otherwise, I do sleep consistently at a set time, and I wake up generally around. A time that I'm happy with.
Speaker 1
So, are there any factors that are preventing you from improving your sleep schedule?
Speaker 2
I think the only thing is still trying to figure out how to make myself get out of bed in the mornings when my alarm goes off. For example, I don't have trouble waking up, but I have a lot of trouble getting myself out of bed, so that's still something that. I haven't really found a solution to and because I'm struggling with it a lot and I don't seem to. Have any ideas on how to solve it? That's the main thing that I'm kind of concerned about.
Speaker 1
Has there ever been a time where you've completely ruined your sleep schedule, and if so, how long did it affect you for in terms of your mood and energy levels?
Speaker 2
So the only times when I've ruined quote unquote my sleep schedule is generally over the holidays. For example, if I. I used to. Stay home and just play games all throughout the night and that would lead me to sleep very late hours or for example I was travelling a lot last holidays and. I got used to getting home around 3:00 to 4:00 AM. Over the holidays, for maybe a few weeks and. Although. I was used to that schedule by the time I got back to UNI. I didn't really have any difficulties going back to my old sleep routine and for example, back when I used to stay up playing video games I would. For example, sleep at. 3:00 PM and then wake up very late past dinner time. But if I wanted to fix my sleep schedule, I would just stay up until I slept at maybe 11:00 or 12:00 PM. So basically my normal sleep time and my body would generally adjust accordingly.
Speaker 1
Do you often feel tired throughout the day?

Speaker 2
I definitely do more so than, for example, back when I was in high school. Nowadays, I almost always need a coffee in the afternoons just to get through the day.
Speaker 1
OK, So what are some things that you do to help maintain your sleep schedule?
Speaker 2
I think the thing that helps me the most in maintaining my sleep schedule is sleeping at a consistent time. So I always aim for around 11:00 or 12:00 PM and I think. Also waking up around 7:00 or 8:00 AM that consistent time of sleeping and consistent wake up time really helps me.
Speaker 1
So consistency is the main thing. OK. Do you ever have trouble staying consistent?
Speaker 2
I generally don't because for example, I do study out late at night, but I always go back home around 10:00 PM so that I can sleep at a consistent time, and I do sometimes. Go out with friends and I do get home very late sometimes, for example 2 to 3:00 AM. But I do feel tired the next day. However, the next day I do consistently sleep at around 11:00 or 12:00, so I think that kind of. Maybe negates getting home late and sleeping late, so for me I don't really have a problem with consistency.
Speaker 1
So is there anything that you think might help you improve your sleep schedule or help you? Sleep better in general.
Speaker 2
I think the only thing that would improve my sleep schedule would be figuring out how to get myself out of bed in the mornings, I think. After I. Kind of solved that issue. I probably won't really have any issues sleeping. I used to have a lot of difficulty falling asleep, but I figured out that listening to music really helps me. So I think eventually I should be able to find a solution.
Speaker 1
OK. That concludes all our questions for today. Thank you.

Interview 5

Introductory Questions

1. How old are you?

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1. What do you study in university

In doing a bachelor of IT

1. Do you think you get enough sleep?

Uhhh I do think I get a solid amount of sleep, probably around 6 to 8 hours a day depending.

1. What else do you do outside of university?

I work a casual job, generally during most of the weekdays .

Questions about sleep

1. Describe your current sleeping schedule.

I have different schedules I guess depending on if its a weekday or weekend. If I see that I have work the following day which is always rather early like 6am to 10am starts I always try to go to bed such that I get at least 6 to 8 hours of sleep when waking up, but there are times I don't really get to do that.

Thats probably because I use my phone waaay too much before bed. I like to read books and whatnot a lot so I'm usually in bed on my phone, but I always try to be conscious of the time, but yeah sometimes I just can't fall asleep and get back on my phone and I end up getting less sleep than usual. Not all the time though. I actually take melatonin supplements if I really feel that I want to get to sleep on time.

Uh my sleeping conditions, well when I'm on my phone I have my bedside lamp on, which I turn off when I feel that I need to try and get to sleep. Uh I also usually turn on some white noise so that I can fall asleep a bit easier since it occupies my background thoughts.It helps quite a bit so I'm not stewing in my thoughts you know.

On weekends I really just sleep when I feel tired, generally around 12am to like 3am. I kinda have to "force" my sleep a lot of the time, I don't really get super naturally tired during the night.

Actually when coming back from work I almost always take a 2 hour nap at like midday since I get really tired then, which probably messes up my circadian rhythm a bit. I always struggle a tiny bit when sleeping at night.

1. How long roughly does it take you to fall asleep?

When actually trying to sleep and not on my phone? Probably between 30 minutes to like and hour and a half, really depends how awake I feel.

1. Do you wake up tired from sleep? (Quality of sleep)

I always wake up in weekday mornings when working kinda reluctant? At least I'm not jumping out of bed and singing and stuff. Its not so bad that I fall back asleep though out of drowsiness, probably because I know I HAVE to wake up.

During weekends though I usually wake up once or maybe twice around 8am to 11am, look on my phone a bit then fall back asleep again and end up actually waking up at like 12pm or 1pm even.

Its probably my circadian rhythm for the weekday making me wake up kind of naturally and the since I don't NEED to wake up I just sleep again.

1. Do you frequently wake up during the night?

Not frequently, but it happens sometimes and I have trouble getting back to sleep, probably because I take naps in the afternoon I don't know really.

1. Are you happy with it? If not, what would you change?

Describe your ideal sleeping schedule.
Im okay with the times I have to sleep but the problem comes with not actually being able to sleep at those times I have set. I kinda don't like having to sleep "early" to wake up early but I have to so its not like I can change it. Ideally I would like to sleep late like 12am to 1am and wake up later like 10am or 12pm like 10 hours of sleep is nice.

1. What are the main factors that prevent you from maintaining your ideal schedule? Is there anything specific that make you stay up late?

Like I said before my phone and probably playing games on my laptop before that. Primarily my phone..

1. Has there been a time where you have ruined your sleep schedule? How/for how long did it effect you (mood, energy levels etc.)? How did you recover from it?

There are times I've stayed up late consistently during uni holidays and when I wasn't working where I'd wake up at like 2pm in the afternoons and sleep at like 3am around that time. I kinda had to fix it when I had obligations though, so I just forced early sleep either my just lying it bed till it happened or taking melatonin.

I've never really had a bad sleep schedule that affected my mood or energy levels I think though when I have a "bad schedule" its usually just me sleeping later and thus waking up later I pretty much always get like a solid number of hours rest, and even if I don't, like 2 or 4 hours, it doesn't feel like it affects me since I just fix it the next day or so. Never really turns into a schedule or consistency, getting low sleep.

Question about lifestyle?

1. Do you often feel tired?

Not necessarily I have afternoon naps a lot though, I get outside of drowsiness when I'm at home at those times and I sleep for like 2ish hours.

1. Do you have trouble waking up early?

Not when I HAVE to. When I don't have to I almost never stay awake during single digit times.

Questions about solutions

1. What are some things you do to help with maintaining sleep schedule?

White noise, supplements and being conscious of the time I need to work the next day and the current time.

1. What are some things that you think may help you sleep better?

Getting off my phone.

11.3 Sleep diary protocol

Sleep Diary

- Write one entry per day
- Write a rough diary entry or list detailing the actions you took before bed that could have influenced your sleep quality.
- Rate your own quality of sleep, from 1 to 5 the next morning.
- Repeat for 5 entries.

Entry structure

Thursday night 5th September

Before sleep

- Talk about the activities you did before bed, maybe an hour or two before actually falling asleep itself, record the rough time you plan to fall asleep or will sleep.

After sleep

- Estimate how many hours you spent sleeping
- Explain briefly how you feel.
- Give a score of your perceived sleep quality.

Write a brief paragraph about how you felt about the sleep diary activity as a whole and if it has affected your perceptions in any way.

11.4 Sleep Diaries:

Team Member 1:

PSQI Score: 6

- **September 5th, 2024**
  - **Before sleep**
    Went to bed at 12:30 am
    Watched YouTube for the past two hours
    Listened to a YouTube video to fall asleep
  - **After waking up**
    Woke up around 6 am
    Slept for 5.5 hours
    I feel rested, so I rate my sleep 4/5
- **September 6th, 2024**
  - **Before sleep**
    Writing at 12:32 am
    No naps today
    Worked on a personal project until 10 pm
    Played a game for the rest of the evening
    Listened to a YouTube video to fall asleep
  - **After waking up**
    Woke up at 5:30 am
    Slept for 5 hours
    I feel mostly rested, 3/5
- **September 7th, 2024**
  - **Before sleep**
    Writing at 1:20 am
    No naps today
    Spent a few hours playing a game and watching YouTube
    Listened to a YouTube video to fall asleep
  - **After waking up**
    Woke up at 7:30 am
    Slept for 6 hours
    I feel rested, 4/5
- **September 8th, 2024**
  - **Before sleep**
    Writing at 1:01 am
    No naps today
    Watched YouTube for a few hours, then did an assignment for the last hour
    Drank a bottle of Coke before bed
    Listened to a YouTube video to fall asleep

    - **After waking up**
      Woke up at 8 am
      Slept for 7 hours
      I feel rested, but my muscles feel sore, 3/5
- **September 9th, 2024**
    - **Before sleep**
      Writing at 12:36 am
      No naps today
      Spent a few hours watching YouTube and doing an assignment
      Listened to a YouTube video to fall asleep
    - **After waking up**
      Woke up at 8 am
      Slept for 7.5 hours
      I feel rested, but my muscles feel sore, 3/5
- **September 10th, 2024**
    - **Before sleep**
      Writing at 12:54 am
      No naps today
      Worked on assignments for three hours
      Listened to a YouTube video to fall asleep
    - **After waking up**
      Woke up at 6 am
      Slept for 5 hours
      I want to go back to sleep, 2/5

Team Member 2:

- **Entry 1 (5/9)**
  Finished classes at 3 pm
  Ate around 7 pm
  Went to sleep at 11 pm
  Sleep quality: 3/5
  Had trouble falling asleep (took 30 minutes), woke up twice but fell back asleep quickly
  Felt groggy in the morning
- **Entry 2 (6/9)**
  Worked on assignments until 6 pm
  Went to bed at 11:30 pm
  Sleep quality: 4/5
  Woke up once but still felt well-rested

- **Entry 3 (7/9)**
  Spent the day at home
  Went to bed at 11:10 pm
  Sleep quality: 5/5
  Fell asleep quickly, slept through the night
- **Entry 4 (8/9)**
  Worked at an event until 8 pm
  Got home at 9:30 pm
  Went to bed at 11:30 pm
  Sleep quality: 4/5
  Took a while to fall asleep, woke up at 4 am but quickly went back to sleep
- **Entry 5 (9/9)**
  Came home at 5 pm
  Took a short nap until 6 pm
  Went to bed at 11:50 pm
  Sleep quality: 3.5/5
  Slept soundly but woke up briefly at 2 am, then quickly fell back asleep

Team Member 3:

September 4th, 2024

- Finished studio work at 12:00 p.m.
- Drove to Fortitude Valley to pick up girlfriend
- Returned home at 5:00 p.m., did laundry, cooked dinner, showered
- Went to sleep at 6:30 p.m. for a long sleep (planned wake-up at 5:30 a.m.)
- Sleep quality: 4/5, woke up once at 1:00 a.m. to use the bathroom

September 5th, 2024

- Left UQ at 8:00 p.m., drove to Macca’s for a Happy Meal
- Set up laptop for an hour, took a shower
- Went to bed at 10:30 p.m., no screen time
- Sleep quality: 3/5, fell asleep quickly but didn’t get enough sleep, disliked early alarm

September 6th, 2024

- Picked up girlfriend at 3:00 p.m., went for a city walk (4:00-6:00 p.m.)
- Had pizza for dinner (6:30-7:30 p.m.), returned home at 8:00 p.m.
- Prepared tomorrow's lunch, showered, played mobile games for 30 minutes
- Went to bed at 10:00 p.m.
- Sleep quality: 3/5, woke up at 5:30 a.m., felt like the sleep duration wasn’t enough but fell asleep quickly

September 7th, 2024

- Finished work at 3:00 p.m.
- Attended a show about Japanese culture (4:00-6:00 p.m.)
- Returned home at 7:30 p.m., showered, studied for an hour before bed
- Went to bed at 10:00 p.m.
- Sleep quality: 3/5, woke up at 5:40 a.m., adapting to early wake-up routine but still dislike it

Team Member 3:

September 8th, 2024

- Finished work at 3:00 p.m.
- Picked up girlfriend at 5:00 p.m., went for dinner at Southbank (6:00-7:30 p.m.)
- Got home around 8:30 p.m., did some laundry and showered
- Went to bed at 9:30 p.m.
- Sleep quality: 4/5, fell asleep quickly, woke up briefly at 2:00 a.m. but managed to go back to sleep easily

September 8th, 2024

- Finished work at 3:00 p.m.
- Picked up girlfriend at 5:00 p.m., went for dinner at Southbank (6:00-7:30 p.m.)
- Got home around 8:30 p.m., did some laundry and showered
- Went to bed at 9:30 p.m.
- Sleep quality: 4/5, fell asleep quickly, woke up briefly at 2:00 a.m. but managed to go back to sleep easily

September 9th, 2024

- Finished work at 3:00 p.m.
- Attended a dinner party (6:00-9:00 p.m.), socializing with friends
- Got home at 9:45 p.m., watched a show for an hour before bed
- Went to bed at 11:00 p.m.
- Sleep quality: 3/5, woke up once during the night, took a while to fall back asleep

September 10th, 2024

- Picked up girlfriend after work at 4:00 p.m.
- Went out to a late dinner at 7:00 p.m., got home at 9:30 p.m.
- Spent some time relaxing and preparing things for tomorrow
- Went to bed at 10:45 p.m.

- Sleep quality: 4/5, felt refreshed in the morning, woke up briefly at 5:00 a.m. but managed to sleep well overall

September 11th, 2024

- Left work at 4:00 p.m., had a team meeting
- Went out to grab some dinner at 6:00 p.m., got home by 7:30 p.m.
- Watched Netflix for an hour, then showered
- Went to bed at 10:15 p.m.
- Sleep quality: 4/5, fell asleep quickly, woke up once but had a restful night overall

Team Member 4:

Sleep Diary Entry 1
Date: 5/9

- Spent the day working on assignments, finished by 8:00 p.m.
- Had a late dinner at 9:00 p.m., then watched TV for an hour
- Went to bed at 11:30 p.m.
- Sleep quality: 3/5, took a while to fall asleep

Sleep Diary Entry 2
Date: 6/9

- Had an early start with an 8:00 a.m. lecture
- Finished the day's work by 5:00 p.m., played video games in the evening
- Went to bed at 11:00 p.m.
- Sleep quality: 4/5, slept well but woke up briefly at 3:00 a.m.

Sleep Diary Entry 3
Date: 7/9

- Spent the day on campus working in the library
- Got home around 6:00 p.m., had dinner at 7:00 p.m.
- Watched Netflix until 10:00 p.m., then prepared for bed
- Went to bed at 10:45 p.m.
- Sleep quality: 5/5, slept through the night

Sleep Diary Entry 4
Date: 8/9

- Had a busy day with back-to-back meetings
- Finished work at 7:00 p.m., had a quick dinner at 8:00 p.m.
- Spent an hour reading before bed
- Went to bed at 11:00 p.m.
- Sleep quality: 4/5, woke up once but overall good sleep

Sleep Diary Entry 5
Date: 9/9

- Spent the day working on a group project
- Finished around 5:00 p.m., played some video games to relax
- Had dinner at 8:00 p.m.
- Went to bed at 11:00 p.m.
- Sleep quality: 3.5/5, woke up once during the night but managed to fall back asleep quickly

Team Member 5:

September 5th, 2024

- Spent the day working on a research assignment, finished around 6:00 p.m.
- Watched TV for 2 hours, had dinner around 8:00 p.m.
- Went to bed at 10:30 p.m.
- Sleep quality: 4/5, slept soundly, woke up feeling refreshed

September 6th, 2024

- Attended a full day of classes from 9:00 a.m. to 4:00 p.m.
- Relaxed in the evening, watched YouTube until 10:00 p.m.
- Went to bed at 11:00 p.m.
- Sleep quality: 3/5, woke up once during the night

September 7th, 2024

- Had a long day working on assignments
- Finished around 7:00 p.m., had dinner and relaxed for a bit
- Went to bed at 10:45 p.m.
- Sleep quality: 3.5/5, took a while to fall asleep but slept well after that

September 8th, 2024

- Spent the day out with friends, had dinner at 7:00 p.m.
- Watched a movie after dinner, got home around 10:00 p.m.

- Went to bed at 11:15 p.m.
- Sleep quality: 4/5, slept soundly

September 9th, 2024

- Worked on assignments during the day, finished by 5:00 p.m.
- Had a relaxing evening, played video games for a few hours
- Went to bed at 10:45 p.m.
- Sleep quality: 3/5, woke up once but managed to fall back asleep

Team member 1:

It is important distinction to note that ALL of my naps are SPONTANEOUS and NOT VOLUNTARY . They are a product of me feeling tired. This probably correlates me lacking in sleep quality overall as I need to compensate with a nap itself. So my perceived quality is probably off.

Team member 2:

I do think that this sleep diary has gotten me to at the very least be more conscious of my sleep quality and how I actually perceive my feelings on the matter. Makes me feel bad about my habits I guess, I felt bad about them before, but now even more so. Revenge bedtime procrastination is very key in my habits here.

Team member 4 PSQI

Component 1 - Subjective Sleep Quality: 1
Component 2 - Sleep Latency: 2
Component 3 - Sleep Duration: 2
Component 4 - Habitual Sleep Efficiency: 0
Component 5 - Sleep Disturbances: 1
Component 6 - Use of Sleep Medication: 1
Component 7 - Daytime Dysfunction: 1
Global PSQI: 8

Team Member 6:

PSQI: 4

4th - Wednesday Night:

- Spent the last few hours in VS Code.
- Went to bed later than usual—was a bit invested in finishing but it took longer than expected.
- Went to bed at 12:00.

5th - Thursday Morning:

- Woke up at 7:00 and watched YouTube Shorts until 8:00.
- Had breakfast and went back to VS Code.

  Thursday Night:

  - Started cooking dinner around 8:30.
  - Finished cooking by 9:15 and ate while watching YouTube until bedtime at 10:00.

6th - Friday Morning:

- Woke up to the alarm at 5:00.
- Felt well-rested.
- A bit tired on the bike ride to work.

  Friday Night:

  - Had dinner while watching YouTube around 7:30.
  - Went to bed at 8:00.

7th - Saturday Morning:

- Woke up by myself just before the alarm at 6:00.
- Felt really well-rested.
- Bike ride to work felt good.

  Saturday Night:

- Played games on the PC for the last two hours and went to bed at 10:30.

8th - Sunday Morning:

- Woke up around 6:30 by myself.
- Watched YouTube Shorts until 7:45.
- Went to work.

  Sunday Night:

  - Watched YouTube Shorts for the last hour before bed.
  - Went to bed at 10:30.

9th - Monday Morning:

- Woke up at 7:00.
- Felt really well-rested.
- Watched YouTube.

  Monday Night:

  - Had a team meeting at 8:00 (-_-).
  - Finished the team meeting around 9:15.
  - Went to bed around 9:30.

11.5 Survey Questions

Survey was done in two parts, first the group's questions, followed by the PSQI test to gauge their sleep..

Groups Questions

1. Briefly Describe some habits and practices that are conducive to sleeping well on a regular basis.
2. What do you think are the biggest challenges or barriers to improving your sleep quality as a university student?
3. What are the most common reasons that impede you from getting good sleep, if ever? (Select all that apply)

4. During the past month, how many minutes did you spend on your devices within one hour before bedtime?
5. What is the main purpose of this screen time before bed?
6. During the past month, how often did spiraling thoughts (negative thoughts) increase the time it took for you to fall asleep?
7. During the past month, how often did late night thoughts (excluding negative) increase the time it took for you to fall asleep?
8. How often do you take naps during the day?
9. If you do nap during the day, how long do your naps usually last?
10. If you nap do they help your overall sleep quality more than they harm it.
11. Briefly describe any sleeping aids/methods to help you fall asleep?
12. Do you take any additional steps during the day to alleviate tiredness.

PSQI Questions

1. During the past month, how many hours per night do you spend in your bed?
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?
3. During the past month, how many hours per night do you spend actually sleeping?
4. During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes?
5. During the past month, how often have you had trouble sleeping because you wake up in the middle of the night or early morning?
6. During the past month, how often have you had trouble sleeping because you have to get up to use the bathroom?
7. During the past month, how often have you had trouble sleeping because you cannot breath comfortably?
8. During the past month, how often have you had trouble sleeping because you cough or snore loudly?
9. During the past month, how often have you had trouble sleeping because you feel too cold?
10. During the past month, how often have you had trouble sleeping because you feel too hot?
11. During the past month, how often have you had trouble sleeping because you had bad dreams?
12. During the past month, how often have you had trouble sleeping because you have pain?
13. During the past month, how often have you had trouble sleeping because of any other reason not described above?
14. During the past month, how would you rate your sleep quality overall?
15. During the past month, how often have you taken medicine (prescribed or “over the counter”) to help you sleep?

16. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?
17. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

11.6 Market research Links

Solution 1: Apple Watch
Website: https://www.apple.com/au/watch/

Solution 2: Sleep Ninja
Website: https://www.blackdoginstitute.org.au/research-projects/sleep-ninja/

Solution 3: Calm
Website: https://www.calm.com/
App: https://play.google.com/store/apps/details?id=com.calm.android&hl=en_AU

Solution 4: MUSE
Website: https://choosemuse.com/
App: https://play.google.com/store/apps/details?id=com.interaxon.muse&hl=en_AU

Solution 5: Sleepon
Website: https://www.sleepon.us/
App: https://play.google.com/store/apps/details?id=com.sleep.on&hl=en_AU

Solution 6: Sleep as Android: Smart alarm
App: https://play.google.com/store/apps/details?id=com.urbandroid.sleep

Solution 7: RISE
Website: https://web.risescience.com/offer/sf
App: https://play.google.com/store/apps/details?id=com.risesci.nyx&hl=en_AU

Solution 8: Stellar Sleep
Website: https://stellarsleep.com/
App: https://play.google.com/store/apps/details?id=one.slumber.client&hl=en_AU

Solution 9: Bía
Website: https://getbia.com/

Solution 10: StayOff: Screen Time Control
App: https://play.google.com/store/apps/details?id=com.app.floatingapptimer.com

Solution 11: Sleep Tracker
App: https://play.google.com/store/apps/details?id=sleeptrakcer.sleeprecorder.sleepapp.sleep

Solution 12: Headspace – Sleep & Meditate
App: https://play.google.com/store/apps/details?id=com.getsomeheadspace.android&hl=en_AU

Solution 13: Beltone Tinnitus Calmer
App: https://play.google.com/store/apps/details?id=com.beltone.tinnitus

Solution 14: Pocket Kado
App: https://play.google.com/store/apps/details?id=com.reverylab.pocketkado.prod

Solution 15: Cognitive Behavioural Therapy for Insomnia in Veterans
Document:
https://www.sleepmattersperth.com.au/wp-content/uploads/CBT-I-Therapist-Manual-vetrnals-Manber-2018.pdf

11.7 Minor Notes on Additional Solutions

Along with the solutions looked more deeper into there were many solutions that shared many commonalities with covered solutions but had 1 or 2 unique ideas that are worth including. So the next section will be a quick overview of these solutions in less detail:

Solution 11: Sleep Tracker - Sleep Recorder
This app appears similar to RISE but also includes nighttime audio recording allowing users to discern these noises, - this can be useful for sleep apnea. The app also includes a smart alarm to gradually wake users up.

Solution 12: Headspace – Sleep & Meditate
Headspace is similar to calm but also includes education on general mindfulness along with the education behind the ideas of mediation.

Solution 13: Beltone Tinnitus Calmer
Similar to calm but allows for customisable soundscapes

Solution 14: Pocket Kado
A gamified version of a habit tracker that is similar to RISE but also has the user engage with a Koala that struggles with a minor eating disorder.

Solution 15: Cognitive Behavioural Therapy for Insomnia in Veterans
This is not a digital solution but a therapy implementation of CBT-I and is what some/many CBT-I app implementations are based on.

11.8 Outline of Universal Ethical Design Considerations

The first is user data privacy (Falbe, 2018), at minimum any design will need to adhere to any relevant country specific regulations such as the Australian Privacy Act or the European General Data Protection Regulation (GDPR). These regulations establish baseline requirements for areas such as data collection, protection against data breaches and explicit user consent

before collecting data. These regulations lay a strong baseline for any privacy related ethical considerations but notably do not by themselves necessarily constitute an ethical design.

On top of the ethics of data privacy any solution should adhere to elements of ethical design (Asscheman, 2024) this requires being user focused to the intended user audience. This user focus will require in-depth knowledge of the audience (Dagfinrud, 2024) and ensure that any design caters for this audience along with ensuring that the design is actually able to perform its intended solution and properly solve the intended problem.

The next aspects of an ethical design are requirements for usability (Asscheman, 2024). This is an important aspect for inclusive design and seeks to avoid overly bearing design aspects that can make a design cumbersome. The next is accessibility, this aspect of design seeks to avoid isolating groups of the intended audience. Both Usability and Accessibility will require targeted user testing for different aspects of the solution.

Lastly for a design to be ethical it should account for broader considerations of societal impacts (Asscheman, 2024). This focuses the designs impact on the world's environment, resources and climate and will require considerations about a solution/products lifecycle and its resultant impacts.

While not comprehensive these 5 aspects of Privacy, User Focus, Usability, Accessibility and Societal implication will be a baseline for any design to be developed and judged. Along with this any user interactions through development should be conducted ethically, this will require that research and testing that includes users is done in an ethical manner relating to privacy and intrusiveness of inquiries and tests, along with any specific ethical concerns of a given test subject/group.