



AGA
Advanced Guidance Assistance
Interim Report

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BSc in Computer Science
(International)

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Abstract

The Advanced Guidance Assistance (AGA) bot is a tool designed specifically to support individuals with ADHD in managing their daily tasks and routines. It acts as a personal assistant that provides structured guidance, reminders, and encouragement to help users stay focused and on track throughout their day. With features like customisable task lists, real-time alerts, and adaptive goal setting, AGA helps reduce stress, anxiety and improve time management, making it easier to build healthier habits and maintain productivity.

Its user-friendly interface and supportive approach aim to empower users to navigate their day more effectively and confidently.

Declaration

I hereby declare that the work described in this dissertation is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

Signed:

Lovely Fernandez

Lovely Joy Velasco Fernandez

04th November 2024

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1. Introduction

1.1 Project Background

What is ADHD?

ADHD, *Attention Deficit Hyperactivity Disorder*, is a neurological condition that affects one's ability to focus, manage impulses, and regulate their energy levels. Individuals with ADHD may experience symptoms such as inattention, hyperactivity, and impulsivity which can impact their daily life, relationships, academic performance, and work.

"ADHD is considered a chronic and debilitating disorder and is known to impact the individual in many aspects of their life including academic and professional achievements, interpersonal relationships and daily functioning." (What Is ADHD?, n.d.)

Difficulties and Challenges of ADHD

According to the DSM-5, there are three presentations of ADHD – *predominantly inattentive*, *hyperactive-impulsive* and *combination* of the two types – where each type faces various challenges from lack of focus and organisation to issues with impulsivity and hyper-fixation. ('Diagnosis of ADHD in Adults', n.d.)

Individuals with inattentive ADHD often struggle to stay focused on tasks or activities, with difficulties in concentration leading to incomplete tasks. They may become easily distracted, frequently misplace or lose items, and face challenges with organisation. This can lead to forgetting daily responsibilities like chores, errands, paying bills, making calls, and attending appointments.

"...adults with ADHD are more likely to experience memory problems, restlessness and lack of mental focus." (Strategies for Adults Living With ADHD | Psychiatrists in California, n.d.)

On the other hand, individuals with hyperactive-impulsive ADHD often display restless behaviours, such as fidgeting, squirming, or tapping. They may also hyper-fixate on specific topics or activities for extended periods, disrupting their daily balance and leading to neglect of other essential tasks, responsibilities, and personal needs. This intense focus can eventually result in burnout, which may impact their sense of self-worth and diminish self-esteem.

"Adults with ADHD may experience poor self-worth, sensitivity towards criticism, and increased self-criticism possibly stemming from higher levels of criticism throughout life." (ADHD - Brainwave Psychiatry and Wellness LLC, 2024)

Lastly, individuals may also experience a combination of both types of ADHD, facing a mixture of the challenges associated with inattention and hyperactivity-impulsivity. Individuals struggling with ADHD affects their ability to have a life balance which in long-term affects their ability to manage work/academic responsibilities, develop a sense of self-confidence and self-worth, and engage in hobbies or recreational activities.

Strategies in how to manage ADHD

In the article *"Strategies for Adults Living with ADHD"* from Advanced Psychiatry Associates, (Strategies for Adults Living With ADHD | Psychiatrists in California, n.d.), five core elements are highlighted to help manage ADHD challenges effectively:

Organisation

Prepare a daily schedule each evening for the following day and review it each morning. This builds awareness of responsibilities and tasks, giving individuals greater control over their day. Focusing on

one task at a time is key to staying on track. Effective time management is also essential: allot extra time for tasks and set reminders and timers to keep on schedule.

Routine

Establishing consistent patterns of behaviour allows individuals to focus on other areas while ensuring that daily tasks are completed. Setting routines for chores, with the help of notifications and reminders, can reinforce habits. For example, setting a monthly reminder for fixed bills and budgeting can provide more control over finances and reduce last-minute stress.

Make Big Tasks Manageable

Breaking large tasks into smaller, achievable steps can reduce feelings of overwhelm, making complex tasks more approachable and allowing for steady progress, one step at a time. Prioritisation is also essential: focus on one item at a time, starting with the most challenging task of the day to make the rest of the day feel lighter.

Minimise Distractions

Creating a clutter-free, minimal environment helps reduce distractions, leading to improved focus and productivity.

Respect Your Limits

Recognising your limits allows for realistic planning, ensuring that daily tasks are achievable. This reduces the likelihood of feeling overwhelmed and increases the satisfaction of completing tasks. Allocate time for well-being activities like quick walks or exercise, which help reduce stress and promote relaxation. Give yourself permission to pause, breathe, and recharge.

Following these core elements can help individuals build self-worth and create a more balanced approach to managing ADHD. Establishing structure and setting realistic goals boosts confidence, while maintaining a routine to reduce overwhelm.

AGA's Solutions and Benefits

After examining the challenges faced by individuals with ADHD and reviewing commonly used strategies to address them, I have identified the essential features AGA can provide as practical tools, as well as how these will benefit individuals in managing their daily lives more effectively.

01	Focus Mode	High Priority
Description A concentration detection device that alerts users when they lose focus on a task or, if it senses signs of intense focus, recommends taking break.		
Benefits This feature supports a healthy balance between task responsibilities and personal well-being.		

Functionality

The device will detect user's eyes and other body parts to analyse one's concentration on a task.

➤ Loses Focus

If the user's vision diverts from the task at hand, with supporting signs like stillness or looking away for an extended period, the device will interpret this as a loss of focus and alert the user by turning red. *A sound alert may also be added.*

➤ Hyper Focus

If the user has spent an extended period on the task, the device will notify them to take a break.

The system will count from when the user starts the task.

Concept Sketch

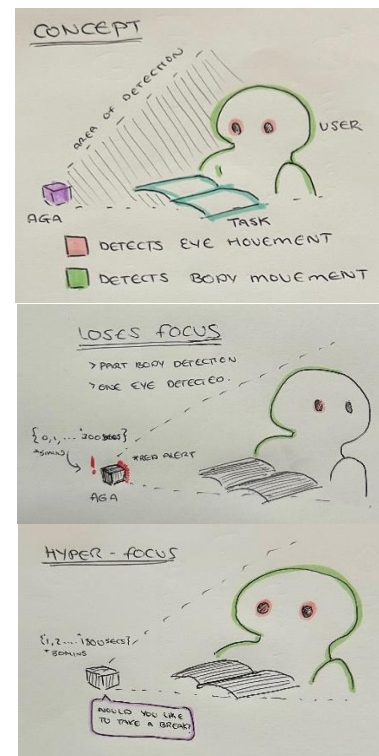


Figure 1.1.A Focus Mode

02

Task Setter

High
Priority

Description

A tool that reminds the user of the tasks that need to be completed for the day. It will send notifications throughout the day, updating on what's left to do and what has been completed. Finally, in the evening, it will give a preview of the next day's tasks to help the user prepare.

Benefits

This tool helps the user stay on top of their tasks. By providing a clear overview of what needs to be done, it reduces anxiety and overwhelm, giving the user a better sense of control over their day. The evening reminders for the next day's tasks also allow them to anticipate what's coming up and prepare.

Functionality

The tool will receive tasks through AGA's web application. It will capture the task name, due date and time, and allow users to assign a priority level to manage urgent tasks first.

Concept Sketch

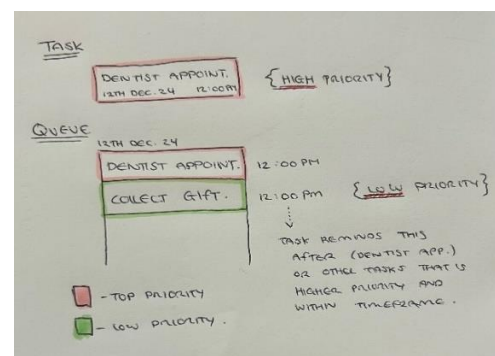
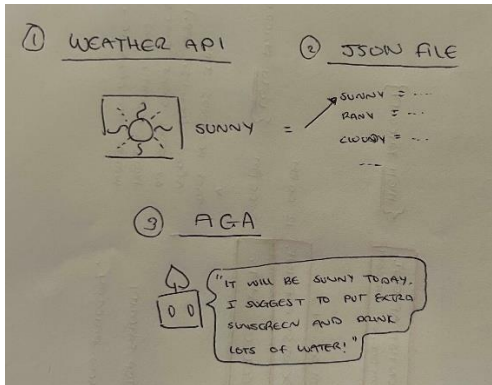
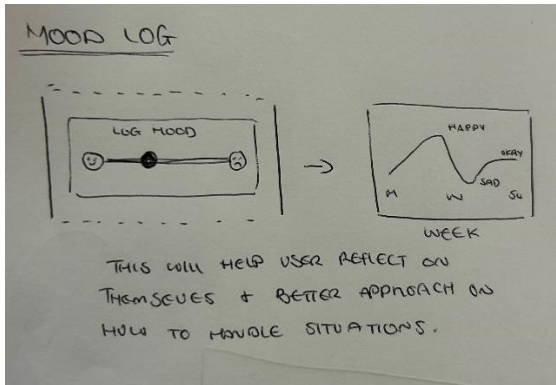


Figure 1.1.B Task Setter

03	Weather API	Mid Priority
<p>Description</p> <p>AGA monitors the weather and provides helpful advice to users based on current conditions.</p> <p>Benefits</p> <p>This feature helps users prepare for their day, minimising any disruptions caused by unexpected weather changes. It's especially useful for individuals who may often overlook daily details, such as those with ADHD, who might forget to check or be aware of the weather forecast.</p>		
<p>Functionality</p> <p>Using the weather API, AGA retrieves the day's weather details and then accesses a JSON file to find the most suitable suggestion for the user.</p> <p>For instance, if rain is expected, AGA might suggest, "It looks like it may rain today; I recommend bringing an umbrella!"</p>	<p>Concept Sketch</p>  <p>Figure 1.1.C Weather API</p>	

04	Mood Log	Mid Priority
Description The mood tracker records the user’s overall mood each day and provides weekly and monthly insights into how they’ve been feeling.		
Benefits This offers a valuable overview of the user’s mental well-being, supporting self-reflection and a deeper understanding of personal emotional patterns		
Functionality The user logs their mood through the mood tracker, which is saved in the database. This data is then displayed on a graph, allowing for easy viewing of weekly or monthly mood trends.	Concept Sketch 	
Figure 1.1.D Mood Log		

05	Daily Affirmations	Low Priority
<p>Description Upon each first login to the web app, the user is greeted with a daily affirmation message to start their day on a positive note</p> <p>Benefits This feature supports mental well-being, a core area where individuals with ADHD often face challenges. The affirmation serves as a reminder of their value and something positive to look forward to each day.</p>		
<p>Functionality Using a random generator, AGA selects a message from a JSON file containing a list of daily affirmations, which is then displayed to the user.</p>		<p>Concept Sketch</p> <p>Figure 1.1.E Daily Affirmations</p>

06	Well-Being Tools	Low Priority
<p>Description This tool offers a range of features focused on well-being, including mindfulness activities like breathing exercises and reflection time, an activity recommender, and a balance system that tracks work and activity hours.</p> <p>Mindfulness Activities These are scheduled notifications prompting the user to engage in activities like breathing exercises or reflection time. AGA guides the user through each step, for example, instructing them to "breathe in and breathe out" during breathing exercises and providing positive reinforcement along the way.</p> <p>Activity Recommender This feature introduces users to new learning or recreational activities, which stimulate the mind and improve mental health.</p> <p>Balance System This system tracks the user's overall work and activity hours, alerting them to any imbalance between work and relaxation. By bringing awareness to any disparities, it helps users understand areas needing improvement, potentially uncovering sources of stress.</p>		

Concept Sketch

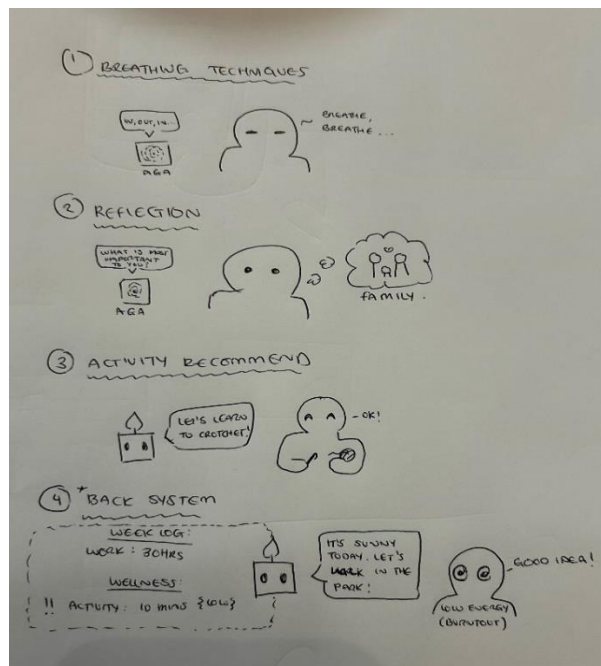


Figure 1.1.F Well-being Tools

1.2. Project Overview

Project Aim

The Advanced Guidance Assistant, AGA, is designed to support individuals with ADHD in managing daily tasks and maintaining a structured, balanced lifestyle. ADHD often brings unique challenges, such as difficulties with *organisation*, *time management*, and *task prioritisation*, which can make daily routines feel overwhelming. AGA aims to provide tailored guidance and assistance to help users tackle these challenges through a structured, user-friendly approach.

By integrating supportive tools and strategies, AGA empowers users to take control of their routines, reduce stress, and enhance their quality of life.

Name of Origin

"AGA" is derived from the word "Agape," meaning "*unconditional love*" in Latin. This term holds personal significance to me, so I wanted to incorporate it into my final year project. Additionally, in Korean, AGA ("아가") means "*baby*," which I felt added a light, approachable touch, presenting AGA as a kind of companion. With this, I decided on the name for my product, which can also be an abbreviation for Advanced Guidance Assistance.

Product Description

AGA is designed as a cubic bot with a leaf on top, embodying the values of balance, growth, and resilience. The cube shape, with its six equal square faces, symbolises unity and balance, while the stable square base represents a strong foundation - *a solid core*.

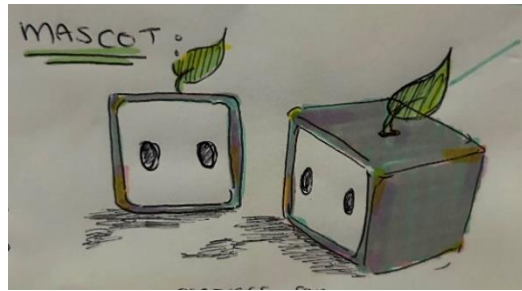


Figure 1.2.A AGA Mascot

This reflects AGA's mission to help users find stability and balance in their lives, strengthening their sense of self. The leaf on top signifies growth and the journey of self-discovery and improvement that users embark upon with AGA.

This idea was inspired by Peter Cromwell's book, "Polyhedra", which explores the symbolic significance of the cube as a representation of stability. As Cromwell stated in page 55, "The cube stands upright on a square base, expressing stability." (Cromwell, 1997)

The cube design also holds personal meaning for me, as it reminds me of my primary school maths class, where we used unit cubes to visualise mathematical logic. As units build up into tens, hundreds, thousands and eventually form larger cubes, they represent progressive growth. Metaphorically, each unit marks the first step toward a goal - starting with one, then ten, then a hundred, then a thousand - ultimately forming a larger whole. This illustrates that each accomplishment is both a milestone and a stepping stone toward an even bigger journey.

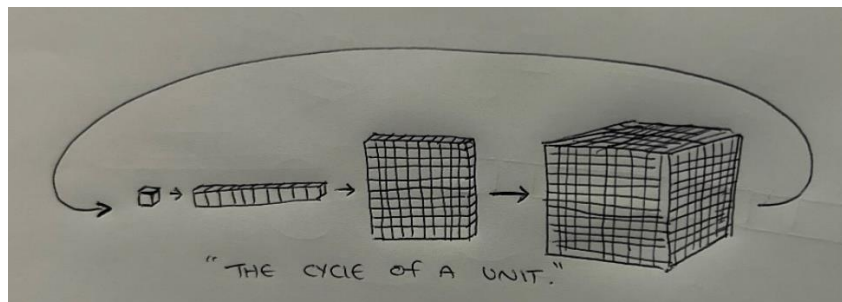


Figure 1.2.B The Cycle of a Unit

This concept forms the foundation of AGA's design, symbolising an individual's journey through life, filled with growth, unity, and the pursuit of life balance. It reflects my life perspective that balance is key to finding peace and harmony in life.

Product Slogan

In the *Project Overview* (Figure 1.2.B), the concept of units is used to represent the first steps toward a goal which inspires the slogan "One Unit at a Time" where each unit symbolises a step, task, or goal in the individual's journey.

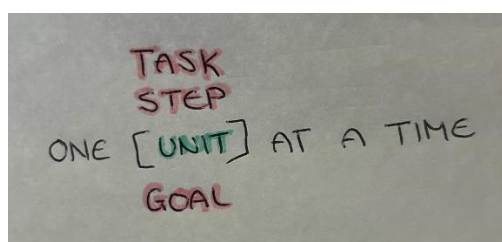



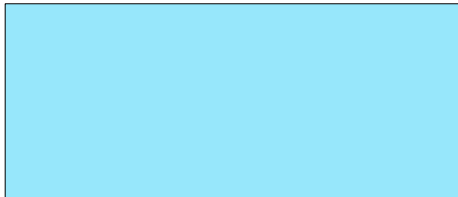


Figure 1.2.C AGA's Slogan

Colour Palette

Primary Colours	
 #7ed348	 #e1f8fe
Secondary Colours	
 #009d01	 #97e7fb

Unique Selling Feature

This is what makes AGA unique - it provides a physical product solution that helps users disconnect from their phones, addressing one of the biggest challenges with modern application solutions. Many current tools are only a swipe away from distraction, keeping users tied to their devices and vulnerable to interruptions.

“Digital distraction refers to the interference caused by digital devices in our lives, leading to decreased productivity, negative impacts on our mental and emotional health, and even physical consequences.” (Digital Distraction and Its Impact on Your Health, n.d.)

AGA, however, offers a simplified distraction-free web-application, allowing users to stay focused without the constant pull of social media and other online distractions. I chose to deliver part of this project through a web application, allowing users to engage with it on various devices, including laptops and desktops, rather than relying solely on a mobile phone.

This multi-device accessibility reduces the dependency on phones, therefore, minimising potential distractions from other mobile applications. AGA’s straightforward approach ensures that users can engage with their tasks without unnecessary complexity.

1.3 Stakeholders

Focus Group

The target market primarily focuses on individuals with ADHD, but also includes students as a secondary user group.

Primary Users

AGA’s tools are designed to fully support individuals with all three types of ADHD - *inattentive, hyperactive-impulsive, and combined*. These users often face challenges with focus, organisation, and task management. AGA’s features, such as Focus Mode, help users find a balance between responsibilities and hobbies, while the Task Setter with reminder functions reduces forgetfulness and supports effective planning.

Secondary Users

The secondary target market is students who are trying to balance academic responsibilities with personal life. Focus Mode can assist students in maintaining concentration to complete their tasks, while also encouraging time for self-care and personal activities. With the Task Setter, students can set reminders for assignments, exams, and other deadlines. The priority feature enables AGA to order the tasks, therefore, allowing the user to focus on one task at a time.

With this targeted market base, AGA is open to various possibilities and opportunities - although developed with individuals with ADHD in mind, AGA is versatile and can also benefit anyone looking for more balance and structure in their lives, such as students or professionals managing demanding schedules.

Investors

With mental health, particularly ADHD, gaining global attention, there is significant raise in investment for innovative digital health solutions. Recent initiatives, such as the UKRI Mindset XR Innovator Support Programme (Farnley, 2024) and Innovate UK's £3.2 million investment in immersive mental health projects (*Innovate UK Invests £3.2m to Improve Mental Health Services*, 2024), highlight the drive to develop accessible, mental health technology-based tools. By using tools like XR (Extended Reality), these programs are helping tackle everything from ADHD to depression, making well-being tools more available and affordable.

Importantly, targeted investments in ADHD-focused solutions, like Inflow's €2 million funding for an ADHD self-management app (*UK Founded Inflow Boosted by €2M Raise for ADHD App*, 2022), showcase the rising demand for digital tools that help individuals manage ADHD symptoms through evidence-based techniques.

With the growing focus on balancing ADHD support and mental well-being, AGA aligns perfectly with these investment interests and contributes to the movement of improving people's mental health.

Other

The stakeholders for AGA include both internal and external groups. Internally, they consist of myself as the developer, my supervisor Bojan Bozic, and TUD staff who will be examining this project. Externally, stakeholders consist of primary and secondary users; *individuals with ADHD* and *students* respectively, as well as *investors* in the healthcare tech industry who are interested in supporting innovative mental health solutions. Healthcare professionals, including psychiatrists and psychologists, are essential for validating the tool and potentially recommending it to patients.

Additionally, mental health advocates, educational institutions that could adopt AGA as a support tool for students, and government bodies focused on mental health initiatives and accessible solutions are key stakeholders in this project.

1.4. Project Scope

The project scope of AGA includes the following components:

❖ Focus Mode

A tool to monitor concentration levels, detecting when a user loses focus or becomes hyper-focused. It provides prompts to help users regain focus or take breaks as needed.

❖ Mood Log

A mood-tracking tool that enables users to log their daily mood and view weekly and monthly trends, supporting self-reflection and mental well-being.

❖ **Task Setter**

A task management feature that allows users to set daily tasks, assign priority levels, and receive notifications throughout the day to help them stay on track.

❖ **Weather Integration**

A feature that checks the day's weather forecast and provides recommendations to help users prepare for weather conditions that may impact their plans.

❖ **Daily Affirmations**

Delivers a positive affirmation on each first login to help boost user morale and encourage a positive mindset.

❖ **Well-Being Tools**

A collection of mindfulness and well-being features, including breathing exercises, activity recommendations, and a balance system to monitor work and relaxation time.

Future Scope

Future developments for AGA could include several additional features to further support individuals with ADHD in managing daily routines and essential needs:

❖ **Food and Water Reminders**

Since individuals with ADHD may often forget to eat or drink regularly, AGA could provide gentle reminders throughout the day to help users meet these basic needs and maintain a healthy lifestyle.

❖ **Routine Guide with Machine Learning**

Using machine learning, AGA could learn users' habits and routines over time, automatically setting reminders for repetitive tasks, such as taking medication, daily exercise, or other regular activities.

❖ **Map and Navigation**

AGA could include a feature where users hold the cube as it provides audio-guided directions, like a GPS. This would be particularly useful for individuals who may feel overwhelmed with navigation.

❖ **AGA Locator**

For users who frequently misplace items, AGA could incorporate a tracking feature. By activating a button on the web app, users could make the cube beep, making it easier to locate AGA if misplaced. This feature would be especially helpful for individuals with ADHD who often lose important items.



Figure 1.4.A Project Concept & Deliverables

These components are delivered through AGA's physical cube device and a web application. The physical cube provides direct interaction for features like Focus Mode, while the web application allows users to set up and manage Task Setters for the cube such as task details and assigning priorities.

1.5. Thesis Roadmap

- | | |
|---|--|
| <ol style="list-style-type: none">1. Introduction and Project Background
This section provides an in-depth study of ADHD, defining the condition, identifying key challenges, and exploring how AGA can serve as a potential solution.2. Literature Review and Existing Solutions
A review of existing solutions and competitors, analysing their strengths and limitations, and comparing them to AGA's unique offerings.3. Project Planning and Feasibility Analysis
Establishes the project management framework and assesses the feasibility and potential success of AGA, considering its impact and usefulness.4. Design and Prototyping
Focuses on selecting the colour palette, UI design, and overall aesthetics of AGA to create a clear vision for the final product. In addition, creating a prototype version to visualise the final product.5. System Architecture and Code Implementation
Covers use cases, requirements analysis, and system modelling to guide the coding process and ensure structured implementation. | <ol style="list-style-type: none">6. Testing and Evaluation
Defines test scenarios, use cases, and testing formats to thoroughly evaluate AGA's functionality and effectiveness.7. Refinement and Final Review
Based on test results, this timeframe is used to refine the code and functionality, enhancing AGA's performance and user experience (UX).8. Documentation and Project Launch Preparation
Finalises all project documentation, including final reports, the user manual, and any additional necessary deliverables.9. Official Website Development and Project Submission
Creates a home landing page introducing AGA's features and benefits, while finalising the project or overview report for submission with all required components. |
|---|--|

Refer to *Project Management section (6.1.1 Milestones and Roadmap)* to review the specific objectives outlined for the project. This section details key milestones which define the project's goals and intended outcomes.

2. Literature Review

This section explores existing solutions, highlighting both similarities to and differences from AGA, to identify the unique features that set AGA apart. It also examines the technologies essential for delivering the project, including tools, frameworks, and platforms best suited to its specific needs.

By reviewing the functional and non-functional requirements of AGA's system, this section establishes a foundation for creating key design elements such as use cases, class analysis, sequence diagrams, class diagrams, and database diagrams which serve as the building blocks for the project's development.

2.1. Competitors and Existing Solutions

Understanding the market competition is essential for defining the value and uniqueness of the project. This section analyses current competitors and existing solutions, evaluating their features, strengths, and limitations.

By identifying what these solutions do well and where they fall short, it highlights how the project can stand out and meet unmet needs. This research also uncovers opportunities for AGA to evolve and improve.

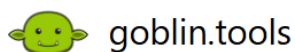
Non-Technical Solutions

Individuals with ADHD often face challenges in managing focus, organisation, and distractions, which can impact their productivity and daily functioning. Non-technical solutions, such as behavioural therapy and practical strategies as outlined in the Introduction (*Section 1, 1.1: What is ADHD?*), are commonly recommended to help individuals manage ADHD effectively. These strategies, include developing organisational systems, minimising distractions, and setting realistic limits to avoid overwhelm.

These solutions have been carefully considered when designing the features of AGA, offering tools that align with these principles such as Focus Mode - *helps users maintain concentration* - and a Task Setter - *supports structured planning with prioritisation*. These core components, along with other smaller features, aim to provide individuals with a platform to reinforce ADHD management strategies. By integrating these tools, AGA aims to encourage individuals to maintain a healthy balanced lifestyle.

Technical Solutions

[goblin.tools](#)



"goblin.tools is a collection of small, simple, single-task tools, mostly designed to help neurodivergent people with tasks they find overwhelming or difficult." (About - GoblinTools, n.d.)

One of the most useful tools in goblin.tools is *Magic Todo* and *Estimator*, a task management system where users can input tasks and allow the tool to generate step-by-step breakdowns, adjusting the level of detail using a scale as well as, edit, reorder, and estimate the time required for each task, promoting better planning.

The platform uses a web-based architecture while offering mobile applications for iOS and Android, providing accessibility and ease of use across devices.

Although goblin.tools offers valuable features, its weaknesses include inconsistent time estimations, often providing different range suggestions when repeatedly submitting the same task, and vague or overly complex task breakdowns when inputs are unclear.

goblin.tools provides a strong foundation for assisting neurodivergent individuals with task management. Similarly, AGA aims to support users in managing tasks effectively but takes a different approach by emphasising the ease of adding tasks and automatically ordering them based on assigned priority weights. This method is designed to make task management more intuitive and user-friendly.

Orotmi



“An Ortomi is an incredibly simple creature, designed specifically to provide companionship, comfort & emotional support – just like a real pets do!” (Ortomi - The Adorable Robot Companion, 2024)

Ortomi is a companion robot build to recreate the emotional connection typically found with real pets, designed to improve mental wellness and alleviate feelings of loneliness, particularly during challenging times such as the COVID-19 pandemic. While Ortomi emphasises emotional support and alleviating loneliness, AGA aims to be a practical companion for individuals, especially people dealing with ADHD, to help them organise their tasks and manage their lives more effectively.

Inspired by Ortomi’s design, AGA aims to achieve Orotomi’s friendly and engaging interactions by incorporating expressive facial features with intent to enhance user engagement and foster a supportive relationship, making AGA not just a productivity tool but also a relatable companion for motivation and support.

Issues with Existing Solutions

After researching existing solutions, a common issue became apparent, most apps marketed for supporting individuals with ADHD primarily focus on task scheduling. While task organisation is a significant challenge for people with ADHD, these apps often overlook other critical struggles, such as maintaining concentration or the ability to prioritise tasks. This trend is evident in many apps, for example, *HelloKlarity* suggested 12 apps for ADHD where at least 5 apps were schedulers for time management. (*Top 12 ADHD Apps In 2024*, 2024)

AGA’s Approach to Identified Issues

AGA aims to address this problem by offering more than just task scheduling features but also its Focus Mode tool, designed to help users stay concentrated on tasks such as assignments or work. In addition, the ability to assign priority weights to tasks allows users to clearly identify and focus on what needs to be done first. AGA ensures that users are better equipped to manage their responsibilities effectively and build good habits for productivity.

2.2 Requirements

Functional

Feature	Description
Focus Mode	Detects user's focus and alerts for loss of concentration or hyper-focus, encouraging breaks.
Task Setter	Provides task reminders, updates throughout the day, and next-day task previews.

Weather API	Retrieves weather data and offers actionable suggestions based on current conditions.
Mood Log	Logs daily moods and provides insights on weekly and monthly trends.
Daily Affirmations	Displays a daily affirmation message upon first login to boost positivity.
Well-being Tools	Offers mindfulness activities, activity recommendations, and a balance system to track work-life hours.



Non-Functional

Feature	Description
Camera Security and Usability Restrictions	Limits camera functionality to protect user safety and privacy.
Adherence to Legal Principles	Ensures compliance with data protection and privacy laws such as GDPR.
Data Minimisation	Collects only the minimum necessary data for functionalities.
Purpose Limitation	Uses data solely for its stated purpose with transparency to users.
Consent Management	Requires explicit user consent before data collection or sharing.
Data Retention Policy	Retains data only as long as necessary for its intended purpose.
Data Integrity	Maintains data accuracy, completeness, and reliability.
Right to Erasure	Allows users to request deactivation or deletion of their data.
Regulation and Law	Users should meet the standard age to access the website.

2.3. Project Technologies and System Deliverables

Programming Languages and Frameworks

The project incorporates a range of programming languages and frameworks to ensure efficient development and compatibility across all different devices.

	Next.js The Next.js framework will enhance performance by enabling server-side rendering, allowing the application to be accessed across multiple devices efficiently.
	HTML CSS JavaScript Core web technologies will be used to build the foundation of the application. HTML structures the content, CSS ensures responsive design, and JavaScript enables dynamic interactions.



Python

Chosen for its simplicity, robust library, and compatibility with hardware components. Python's flexibility makes it an ideal choice for implementing core functionality on Raspberry Pi.

Software Infrastructure

The software infrastructure includes weather APIs for dynamic, location-based updates and a real-time synchronised database to ensure consistent data sharing across the system.



Firebase

Acts as the project's primary database, storing user data, task lists, preferences, and progress. Firebase's real-time database capabilities ensure smooth synchronisation and scalability across devices.



Google APIs

Using Google APIs to connect the app with external tools such as weather APIs.

Hardware Requirements

AGA, the physical component of this project will utilise a Raspberry Pi as its central hardware component, with the following elements:

- ➔ **Camera:** To monitor user focus and detect signs of hyperfocus for the Focus Mode feature.
- ➔ **Microphone:** To enable voice interaction and command recognition.
- ➔ **Display:** A screen to present well-being messages, and for facial expressions of the robot for an engaging user experience.
- ➔ **Speaker:** For delivering audio feedback, reminders, and well-being cues.

**If the Raspberry Pi setup is not feasible, the project can be adapted into a mobile application, leveraging the phone's built-in hardware - camera, microphone, and speaker.*

The technical framework, incorporating technologies such as Next.js, Firebase, and a robust MVC architecture, ensures scalability, reliability, and an enhanced user experience. AGA's physical component, powered by Raspberry Pi, integrates interactive hardware such as a camera, microphone, display, and speaker. These components enable features like focus detection, voice commands, expressive feedback, and audio cues, creating a user-friendly, engaging, and distraction-free environment.

Deliverables

The deliverables for this project include two distinct components: *a web application* and *a robot product*, each designed to offer and support specific features of AGA.

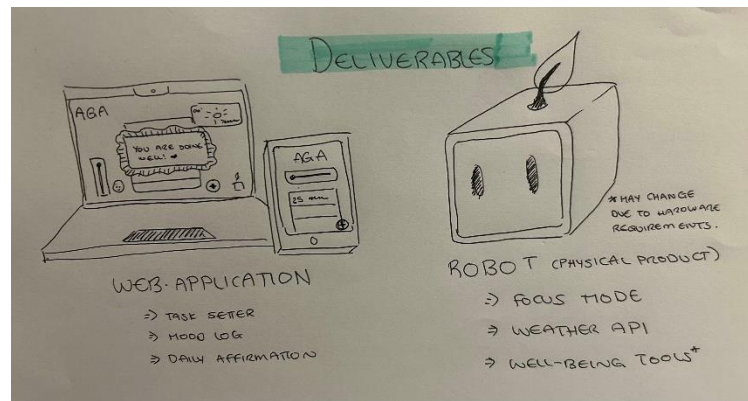


Figure 2.3.B Project Deliverables

Web Application includes:

- ❖ Task Setter
- ❖ Mood Log
- ❖ Daily Affirmations

Robot Product includes:

- ❖ Focus Mode
- ❖ Weather API
- ❖ Well-Being Tools

The web application was chosen to ensure accessibility across multiple devices, allowing users to manage their tasks and mood logs. AGA, the physical product, is designed to reduce reliance on mobile phones by providing a simplified, distraction-free interface, particularly during study or work sessions. It discourages phone usage during focused activities, helping users stay on task and minimise distractions.

2.4. Other Research

Existing Final Year Project

As part of the research for this project, I explored previous fourth-year projects from earlier years to gain insights and identify similarities to my own concept.

Deep

“This project is focused on designing and developing a web application that serves as a tool for enhancing productivity and effective time management. In today’s digital world, the issue of distractions and lack of focus has become increasingly widespread, creating challenges for individuals attempting to maintain productivity and accomplish their goals.

To address this concern, the project aims to offer a practical and user-friendly solution that promotes focus and minimizes distractions. The web application enables users to effectively organize and manage tasks, while also providing visibility into deadlines. Additionally, it offers insights into the time spent on work, helping users optimize their productivity.” (Deep, James Carswell (2023))

Author	James Carswell C19749651
Description	This web application is designed to create a distraction-free environment, helping users, particularly university students, focus on long, meaningful work sessions. It acts as an immersive productivity tool for organising tasks and managing work sessions effectively.
Complexity of the Project	The complexity of this project arises from multiple factors, including understanding and addressing user behaviour to promote focus, processing real-time data for task tracking, and

providing personalised analytics through intuitive visualisations. Additionally, Deep adapts to continuous feedback while maintaining user engagement which adds another layer of complexity.

Technical Architecture

The technical architecture of this project includes a front-end built with TypeScript, React.js, Vite, and SASS, creating a responsive user interface. The back end is developed using Go (Gin framework) with GORM for database handling, while the PostgreSQL database manages data storage. The architecture also supports both SQL and JSON querying, allowing for flexibility in handling and processing user data.

Strengths

➤ Real-time Productivity Tools

The ability to track tasks and visualise progress in real time boosts focus and productivity.

➤ User Engagement

The personalised analytics and study tools cater well to university students, helping them maintain attention and build efficient work habits.

Weaknesses

• Complexity in User Behaviour Tracking

Understanding user focus and behaviour can be challenging and may require further research and testing.

• Potential Performance Bottlenecks

Real-time data processing and the need for frequent updates to the UI could create performance challenges, particularly as the user base grows.

This research provided useful insights that helped shape AGA's features and design. By examining the strengths and challenges of Carswell's project, including his use of a real-time task tracker and customised tools to strengthen user engagement, AGA aims to create an effective, user-friendly design and a reliable system setup that is well-suited to the needs of individuals dealing with ADHD.

3. System Design

This chapter outlines the design of the proposed system, detailing the methodology, system architecture, and the key components necessary for implementation. It provides a structured blueprint for the development process of AGA.

3.1. Software Methodology

Development Methodology

The development methodology for this project primarily draws from the traditional Waterfall model, providing a structured and linear approach to project planning and implementation. However, elements of the Agile methodology are incorporated throughout the process to introduce flexibility and iterative development.

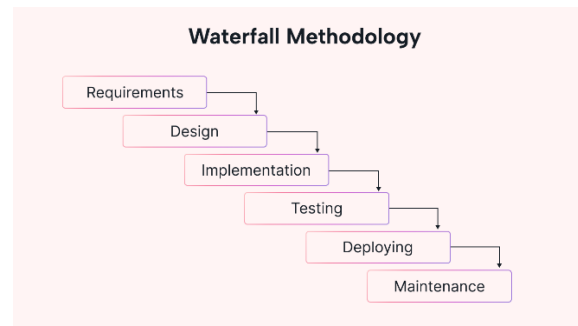


Figure 3.1.A Waterfall Methodology

The traditional Waterfall model establishes a clear sequence of phases - *requirements gathering*, *design*, *implementation*, *testing*, *deployment*, and *maintenance* - ensuring that all steps are well-documented providing a strong foundation for project management and ensures that key milestones are met in a structured manner.



Figure 3.1.B Agile Methodology

To complement this, an Agile approach is integrated, allowing the project to adapt to changes and continuously improve through *iterative cycles*, or *sprints*.

Each sprint includes planning, task allocation, execution, review, and adjustment phases. This iterative method allows a quick response to feedback, address issues as they arise, and enhance project quality progressively.

“Agile teams also believe in continuously evaluating project plans and objectives. As a result, they are highly flexible and can quickly adjust to change...Adopting the Agile method will allow you to operate in a detail-oriented manner.” (Team, 2022)

By combining the detailed planning of the Waterfall model with the adaptability of Agile, this hybrid methodology ensures both a clear project direction and the ability to refine and enhance the project based continuous evaluations and user feedback. This approach helps maintain high-quality deliverables while meeting the dynamic needs of the project.

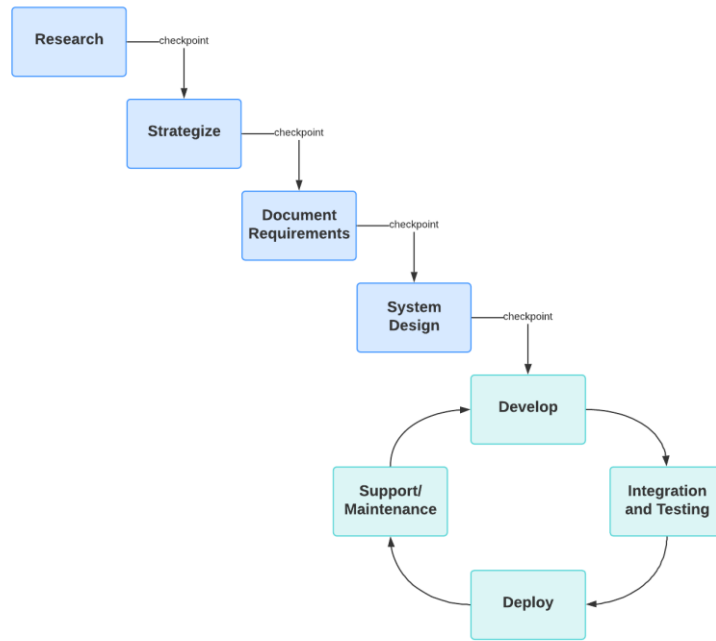


Figure 3.1.C Hybrid Waterfall and Agile Methodology

More information regarding task distribution in 6. Project Management (6.1 Project Plan).

3.2. Overview of System

The system is designed with three primary components to ensure smooth operation and interaction: a *frontend UI*, a *backend server*, and a *database*.

Frontend UI	Allows users to input data through a web application. This interface is built using modern web technologies like Next.js, HTML, CSS and JS to ensure accessibility across multiple devices.
Backend Server	Processes the user inputs and facilitates communication between the frontend and the database. This is where the core functionality is executed.
Database	Stores user data, including tasks, mood logs, and preferences, and ensures real-time synchronisation across all components.

In addition to AGA’s web application, where users can manage their tasks, mood logs, and other services, the physical bot product also requires the development of hardware components such as a *Raspberry Pi*, *camera*, *microphone*, and *display* to interact with users.

These hardware elements are integrated with the backend database to retrieve and store data. Python is used to handle interactions between the hardware and users, enabling features like focus detection, audio prompts, and task updates.

System Architecture

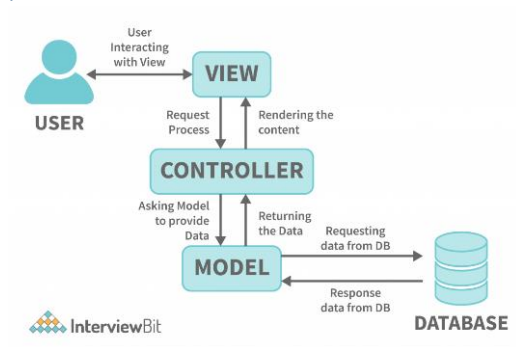


Figure 3.2.A MVC Architecture

This project adopts the Model-View-Controller (MVC) architecture to ensure maintainability and scalability achieving a robust structure that supports efficient data handling, responsive UI, and a seamless user experience.

Model	The database (Firebase) serves as the model, managing user data, task lists, preferences, and other information in real-time.
View	The user interface is built using Next.js framework, ensuring responsive interaction across devices.
Controller	Next.js handles the server-side logic, API requests, and routing to connect the user interface with the underlying data and services, such as Google's Weather API.

3.3. Requirement Analysis

Use Case Diagrams

These diagrams help in identifying system requirements and ensuring that all user needs are addressed effectively.

In the context of this project, the term *user* refers primarily to individuals with ADHD, who are the main target audience for AGA's features and functionalities. Secondary users, such as students and other individuals seeking tools for productivity and focus, are also considered.

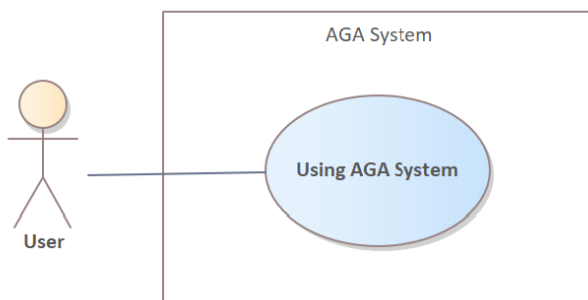


Figure 3.3.A Use Case 1 Using AGA System (UML2)

Use Case 1: Using AGA System	
Goal	User can use AGA's tools.
Preconditions	User requires a verified account.
Postconditions (Success)	User can access AGA's tools.
Postconditions (Failed)	User is unable to access AGA's tools due to unverified account.
Actors	Users (Individual with ADHD or Student)
Trigger	User wants to use AGA's system
Description	User logs/create an account to use the tools AGA offers.
Priority	High

Main Flow (MF)		
Step	Action	Alternate
1.1	System prompts for user access details	
1.2	User inputs their user details	EF.1.2

1.3	System verifies user details are correct	EF.1.3
1.4	System gives access to the user and directs to AGA's base page	
1.5	User accesses AGA's tools on the web application	End of MF
Exceptions or Error Flows		
Exception/Error Flow 1.2: MF.1.2 User does not have an account		
1.1	User registers an account	MF.1.1
Exception/Error Flow 1.3: MF.1.3 User input incorrect user access details		
1.1	System prompts user of the error – <i>'Incorrect email or password'</i>	
1.2	User re-enters user access details	MF.1.3
Non-Functional Requirement		
Adherence to Legal Principles	Ensures compliance with data protection and privacy laws such as GDPR.	
Regulation and Law	Users should meet the standard age to access the website.	
Data Minimisation	Collects only the minimum necessary data for functionalities.	
Purpose Limitation	Uses data solely for its stated purpose with transparency to users.	
Consent Management	Requires explicit user consent before data collection or sharing.	
Data Retention Policy	Retains data only as long as necessary for its intended purpose.	
Data Integrity	Maintains data accuracy, completeness, and reliability.	
Right to Erasure	Ensures compliance with data protection and privacy laws such as GDPR.	

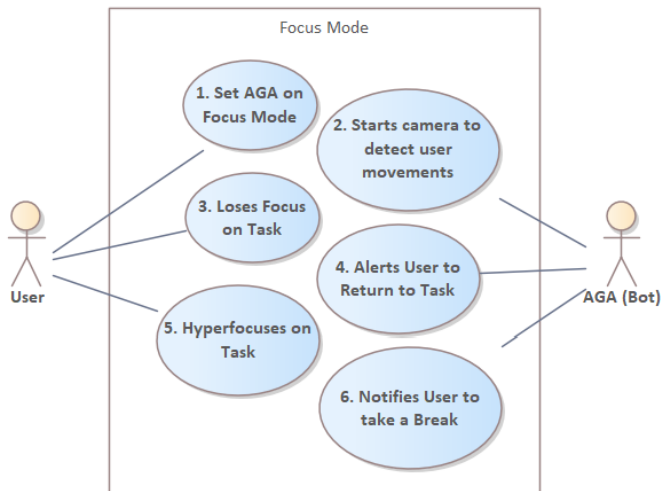


Figure 3.3.B Use Case 2 Focus Mode (UML2)

Use Case 2: Focus Mode	
Goal	User completes a task
Preconditions	AGA is set in front of User where their eyes are visible, and Focus Mode is enabled
Postconditions (Success)	AGA can detect User's concentration level and provide appropriate feedback
Postconditions (Failed)	AGA is unable to deliver its service due to system or hardware error
Actors	User, AGA Bot
Trigger	User wants to study/work therefore enabling Focus Mode
Description	User sets AGA on Focus Mode to start studying/working. AGA enables its camera to detect and alert user accordingly to complete task.
Priority	High

Main Flow (MF)		
Step	Action	Alternate
1.1	User sets AGA in front of them and enables focus mode	EF.1.1
1.2	AGA Bot alerts user they are detected	
1.3	User starts task	EF.1.3
1.4	User hyper fixates on task	
1.5	AGA Bot turns blue and alerts user to take a break	AF.1.5

1.6	User continuous to work on task and completes it	End of MF
Exceptions or Error Flows		
Exception/Error Flow 1.1: EF.1.1 AGA is unable to detect User		
1.1	System prompts that it is unable to detect user	
1.2	User re-positions AGA Bot	MF.1.1
Exception/Error Flow 1.3: EF.1.3 User loses focus on Task		
1.1	AGA Bot turns red and alerts user to return to Task	
1.2	User returns to the task	
Alternative Flows (AF)		
Alternative Flow 1.3: AF.1.5 User loses focus on Task		
1.1	User takes a break	
1.2	User returns to task	MF.1.6
Non-Functional Requirement		
Camera Security and Usability Restrictions		Limits camera functionality to protect user safety and privacy.

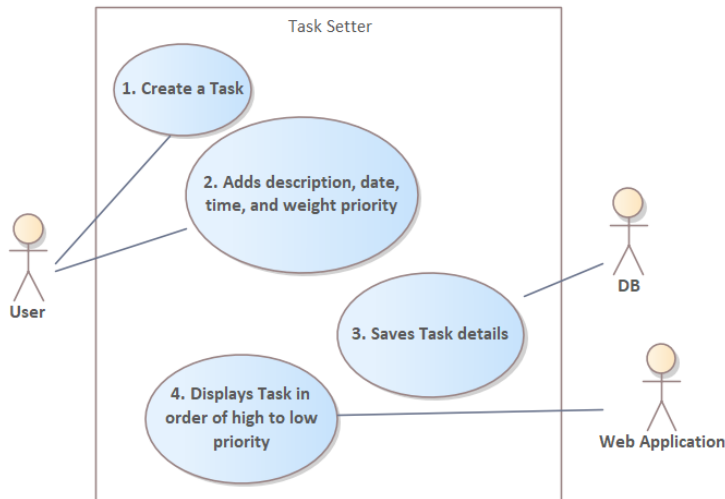


Figure 3.3.C Use Case 3 Task Setter (UML2)

Use Case 3: Task Setter	
Goal	User can add task and get a clear view of what to prioritise first
Preconditions	User is logged into account
Postconditions (Success)	Task is added onto scheduler ordered in high to low priority
Postconditions (Failed)	Task is not saved on scheduler
Actors	User, DB, Web Application
Trigger	User needs a reminder for a task
Description	User adds a task on scheduler, adding the description, date, time and priority weight.
Priority	High

Main Flow (MF)		
Step	Action	Alternate
1.1	User creates a task adding description, date, time and weight priority	
1.2	System checks double scheduling	EF.1.2
1.3	System adds task in DB	
1.4	System displays tasks in order of priority weight	
1.5	User opens the days' task lists to have a clear view of what to prioritise first	End of MF
Exceptions or Error Flows		
Exception/Error Flow 1.2: EF.1.2 Double Scheduling of Task		
1.1	System prompts user there is a task scheduled during this time	
1.2	User confirms	
1.3	System blocks enough appropriate time for these tasks to be completed on calendar	AF.1.3
1.4	System adds task and orders the tasks in high to low priority	MF.1.4

Alternative Flows (AF)		
Alternative Flow 1.3: AF.1.3 Not enough time to add new task		
1.1	System prompts user it is unable to add task due to lack of time space	
1.2	User updates time or date	MF.1.2
Non-Functional Requirement		
Data Minimisation	Collects only the minimum necessary data for functionalities.	
Purpose Limitation	Uses data solely for its stated purpose with transparency to users.	

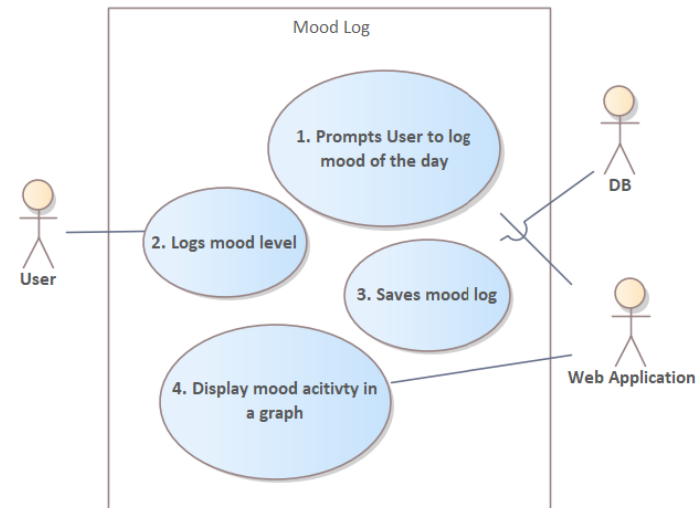


Figure 3.3.D Use Case 4 Mood Log (UML2)

Use Case 4: Mood Log	
Goal	Allow user to visually analyse the mental progression in a weekly or monthly basis.
Preconditions	User is logged into account
Postconditions (Success)	User logs mood activity and display logs into a visual graph
Postconditions (Failed)	Web App is unable to fetch logs from DB to produce a graph
Actors	Actor, DB, Web App
Trigger	User accesses account to check their mental progression
Description	User is prompted to log mood activity, and a graph is displayed of weekly or monthly logs
Priority	Mid

Main Flow (MF)		
Step	Action	Alternate
1.1	User access AGA's Web App	
1.2	System prompts user to log mood activity	AF.1.2
1.3	User logs mood	
1.4	System saves logs into the database	
1.5	System displays logs in a visual graph	EF.1.5
1.6	User switches between weekly or monthly graphs	End of MF
Exceptions or Error Flows		
Exception/Error Flow 1.5: EF.1.5 Unable to fetch data from database		
1.1	System displays an empty graph with an error message	
1.2	User reports technical issue	
1.3	Support service fixes the technical issue	MF.1.5
Alternative Flows (AF)		
Alternative Flow 1.2:		
1.1	User cancels/exits the prompt	
1.2	System sets a timer and asks again or next time user accesses the web app again	End of AF
Non-Functional Requirement		
Data Minimisation	Collects only the minimum necessary data for functionalities.	
Purpose Limitation	Uses data solely for its stated purpose with transparency to users.	
Consent Management	Requires explicit user consent before data collection or sharing.	
Data Retention Policy	Retains data only as long as necessary for its intended purpose.	

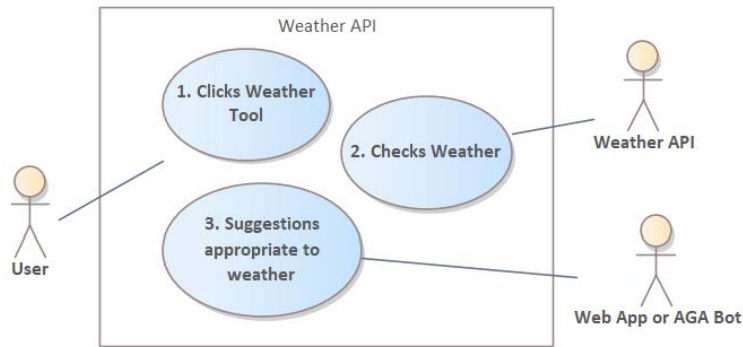


Figure 3.3.E Use Case 5 Weather API (UML2)

Use Case 5: Weather API	
Goal	Identify what weather it is and prepare appropriately
Preconditions	Connected to Weather API and JSON file for suggestions
Postconditions (Success)	Web App/AGA Bot can suggest what user should prepare for the day
Postconditions (Failed)	Unable to read weather API/JSON file to provide suggestion
Actors	User, Weather API, Web App/AGA Bot
Trigger	User is looking for suggestions base on weather
Description	User prompts system for weather suggestion, system checks weather, compares the findings to JSON file to provide appropriate suggestions
Priority	Mid

Main Flow (MF)

Step	Action	Alternate
1.1	User accesses Web App	
1.2	User prompts the Weather Tool	
1.3	System checks user's location	EF.1.3
1.4	Weather API checks weather for that location	EF.1.4
1.5	System reads JSON file based on weather findings	
1.6	System suggests user appropriately	End of MF

Exceptions or Error Flows

Exception/Error Flow 1.3: EF.1.3 User's Location is disabled

1.1	System prompts user for location access permissions	
1.2	User enables location on	MF.1.3

Exception/Error Flow 1.4: EF.1.4 Weather API is not working

1.1	System prompts user that the Weather tool is facing a technical issue	
1.2	System refreshes in the background	MF.1.2

Non-Functional Requirement

Adherence to Legal Principles	Ensures compliance with data protection and privacy laws such as GDPR.
Consent Management	Requires explicit user consent before data collection or sharing.
Data Retention Policy	Retains data only as long as necessary for its intended purpose.
Data Integrity	Maintains data accuracy, completeness, and reliability.

Class Analysis

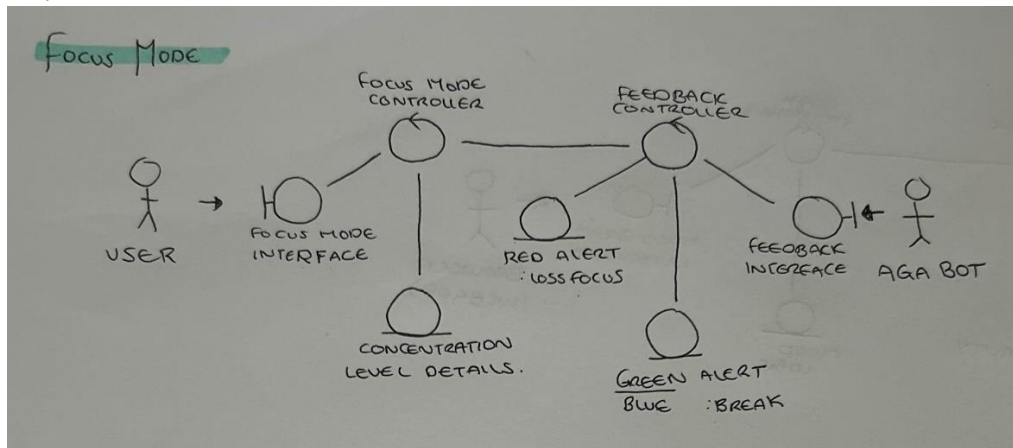


Figure 3.3.F Class Analysis Focus Mode

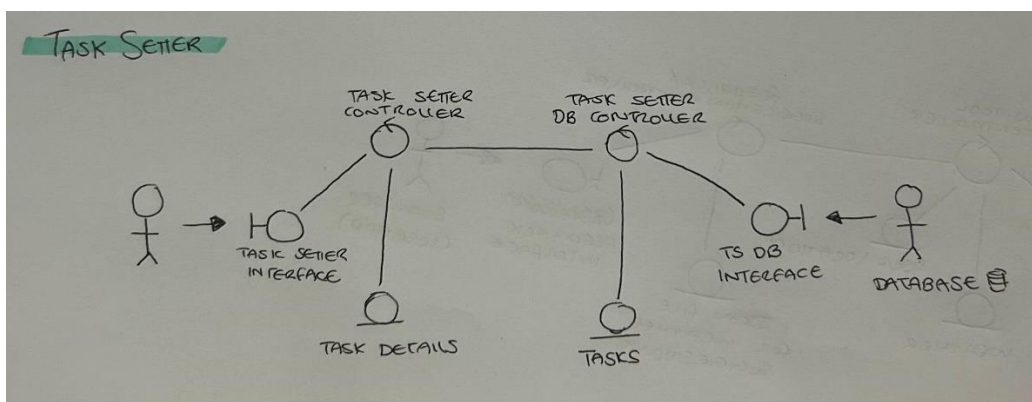


Figure 3.3.G Class Analysis Task Setter

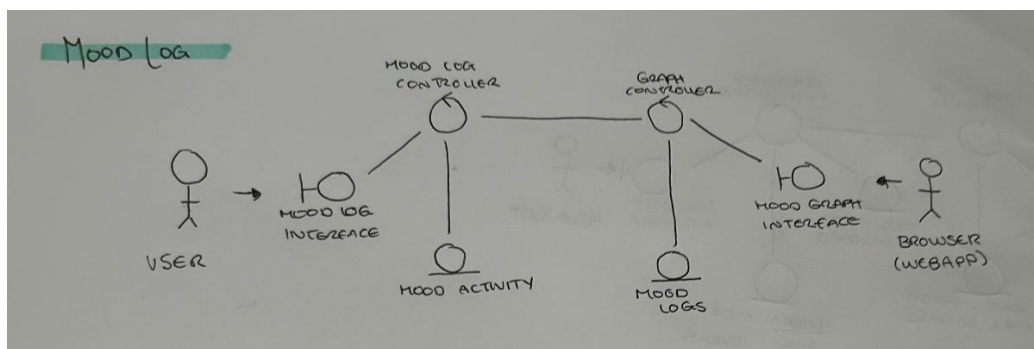


Figure 3.3.H Class Analysis Mood Log

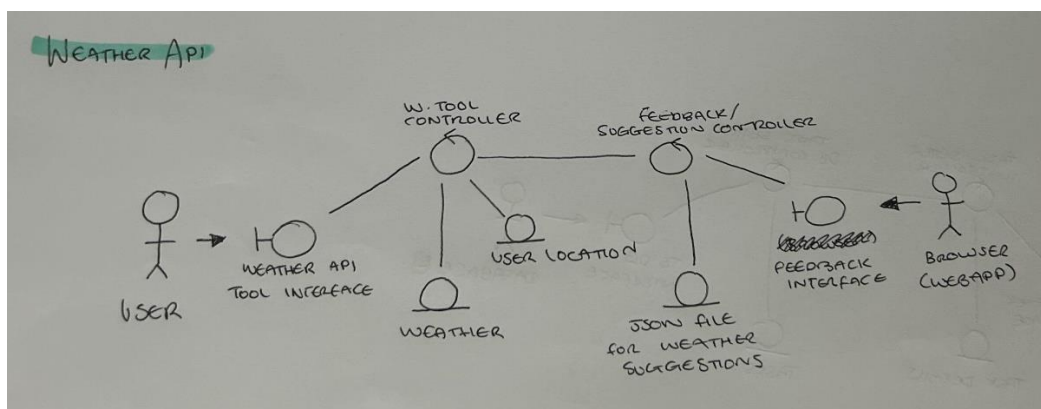


Figure 3.3.I Class Analysis Weather API

Class and Sequence Diagram

Focus Mode

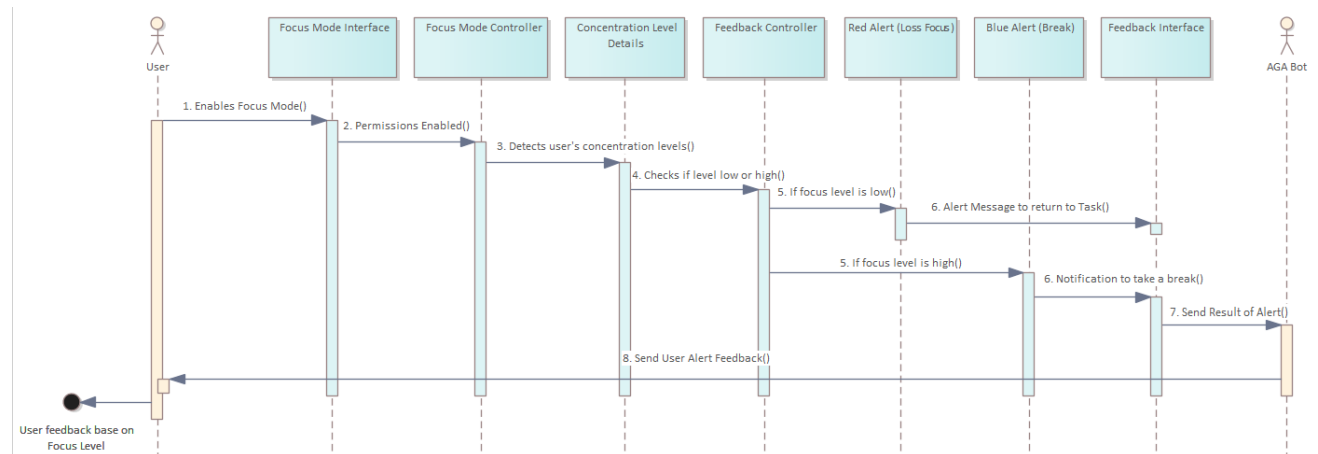


Figure 3.3.J Informal Sequence Diagram Focus Mode

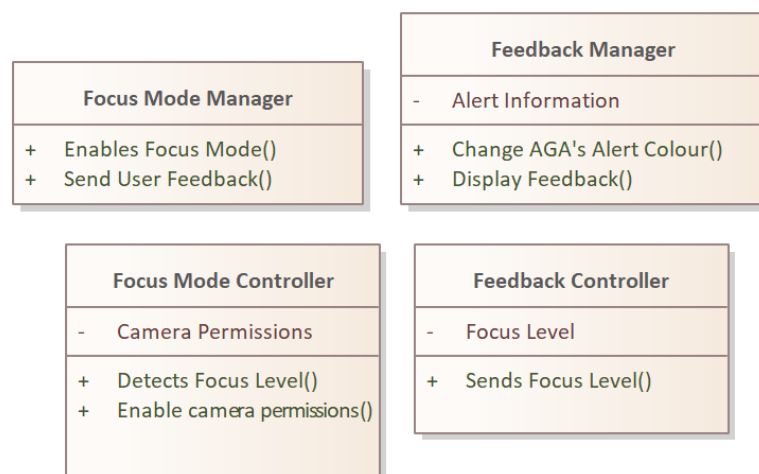


Figure 3.3.K Class Diagram Focus Mode

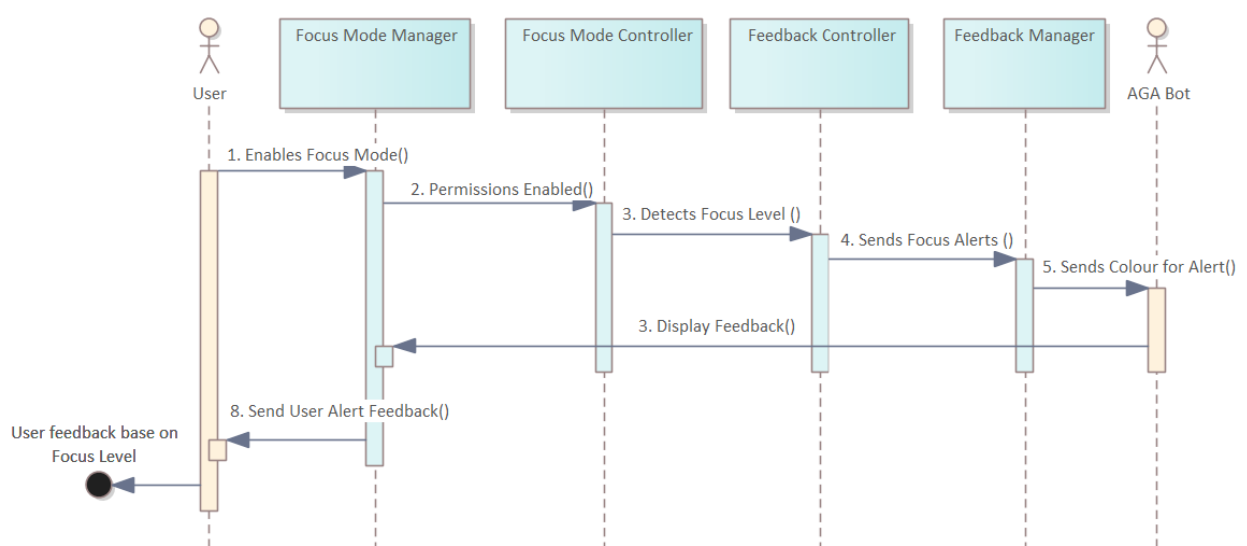


Figure 3.3.L Formal Sequence Diagram Focus Mode

Task Setter

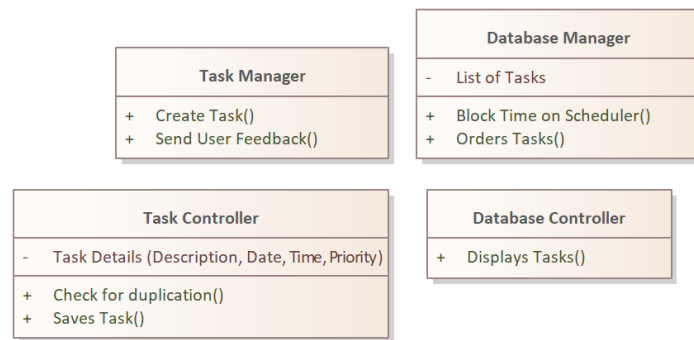


Figure 3.3.M Class Diagram Task Setter

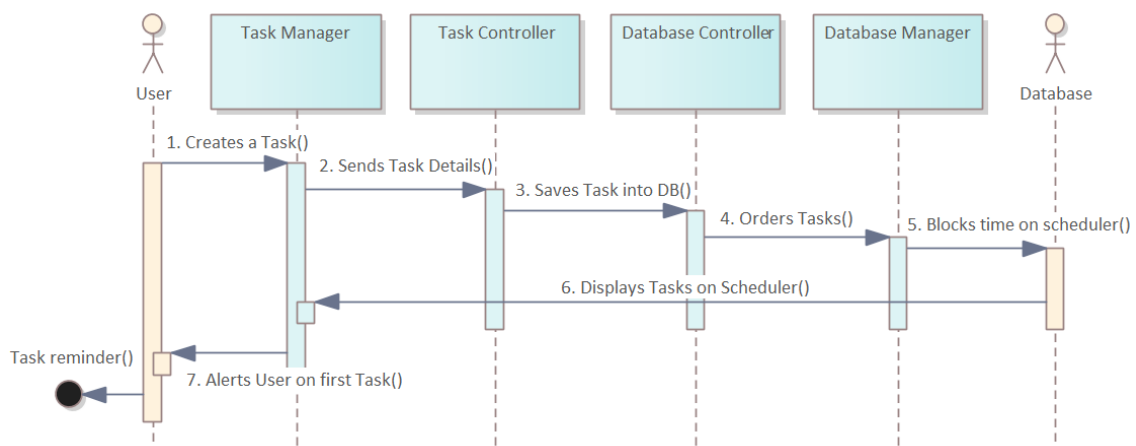


Figure 3.3.N Formal Sequence Diagram Task Setter

Database Diagram (ERD)

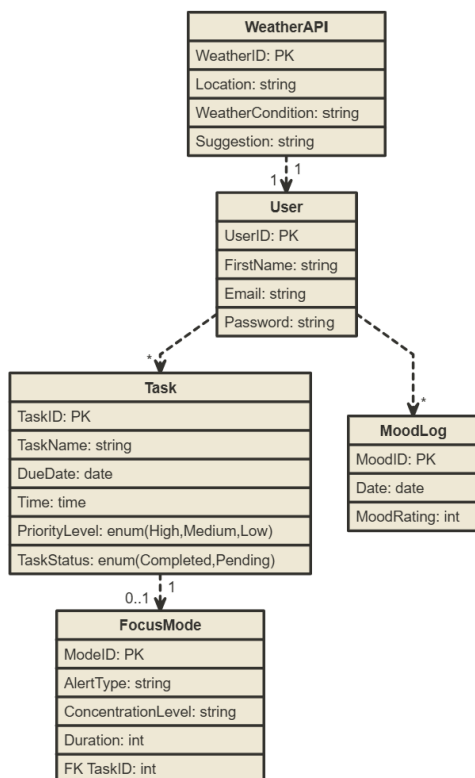


Figure 3.3.O Entity Relation Diagram

Key System Relationships

Weather API to User (1 to 1)

Weather suggestions provided by the Weather API are personalised for individual users, such as recommendations tailored to their location or preferences.

User to Task (1 to Many)

A single User can create multiple Tasks, but each Task is associated with only one User. Users are responsible for creating and managing their own tasks, and this relationship ensures that tasks are directly associated with their creator.

Focus Mode to Task (1 to 0..1)

Focus Mode functionality is tied to a specific task to monitor the user's concentration during that task.

**However, Focus Mode can be used even if Task is not on Scheduler for Focus Detection Tool purposes.*

Mood Log (1 to Many)

A single User can have multiple Mood Log entries, but each Mood Log belongs to only one User. Mood logs allow users to track and analyse their emotional state over time. Each entry is tied to the user who recorded it.

Task to User

Tasks include a foreign key UserID to link tasks to their creators.

This ensures that all tasks are associated with a valid user, maintaining the integrity and reliability of the database.

3.4. Project Design

Web App and Bot Sitemap

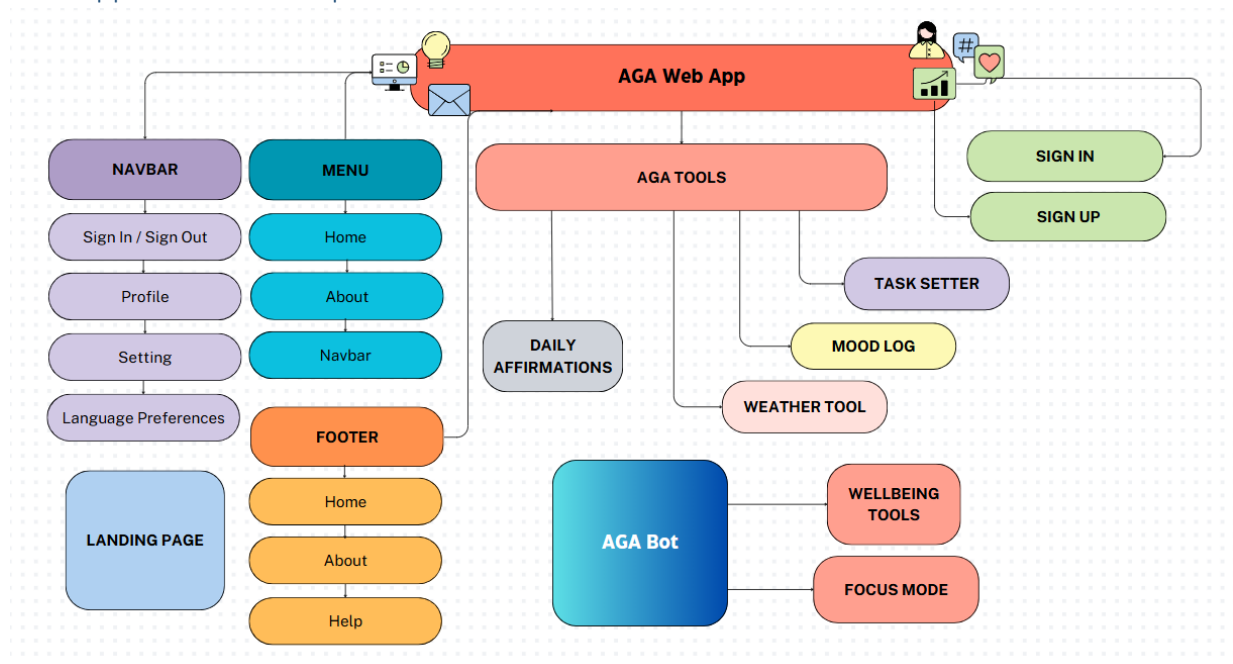


Figure 3.3.P Sitemap

Web App GUI Prototype

The image shows a Web App GUI Sign In/Up prototype. It features a teal background on the left with a stylized blue robot head icon and the text **AGA** and **Advanced Guidance Assistance**. On the right, there is a white form titled **Create new Account** with a link **Already Registered? Login**. The form includes input fields for **Please enter your first name** (Jiara Martins), **Please enter Email** (hello@reallygreatsite.com), **Please enter password** (*****), and **Please enter date of birth** (Month and Year). A green **SIGN UP** button is at the bottom.

Figure 3.3.1 Web App GUI Sign In/Up

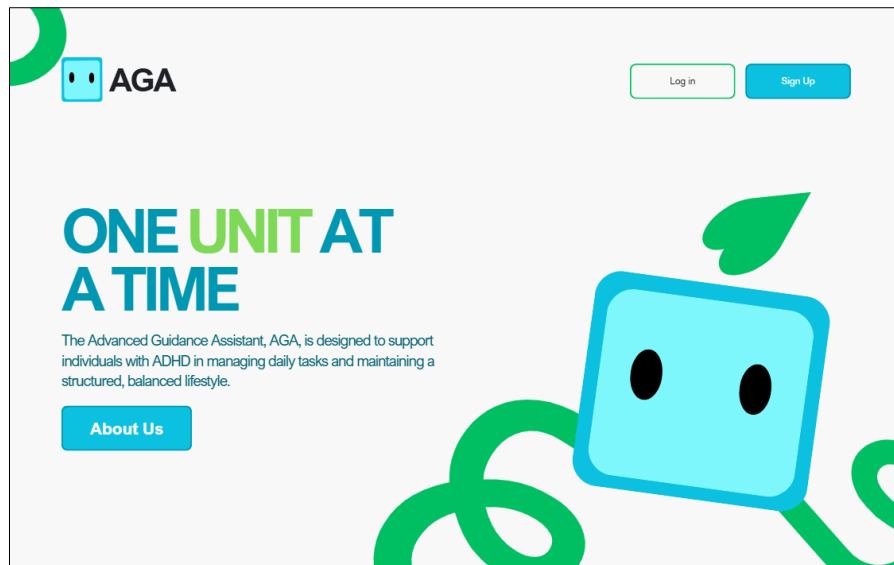


Figure 3.3.1 Web App GUI Landing Page

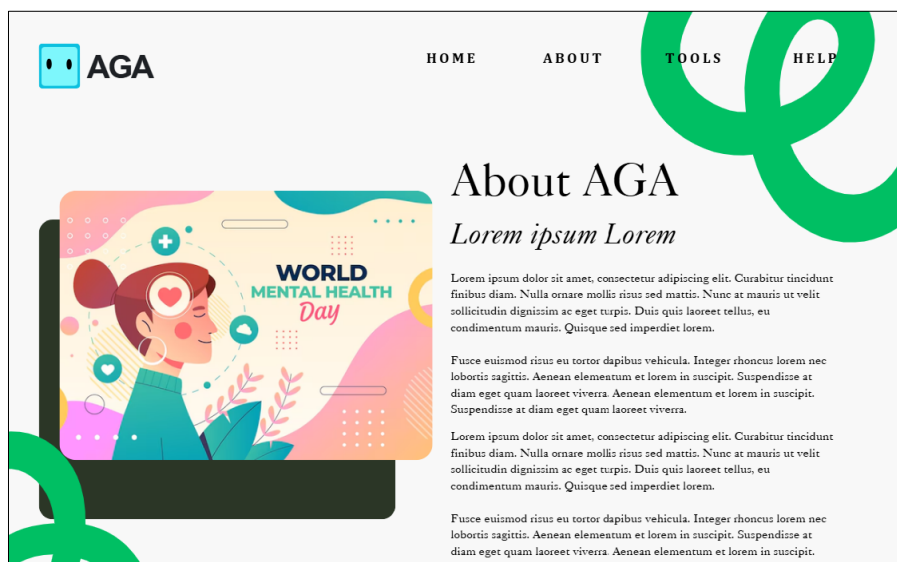


Figure 3.3.2 Web App GUI Landing Page: About

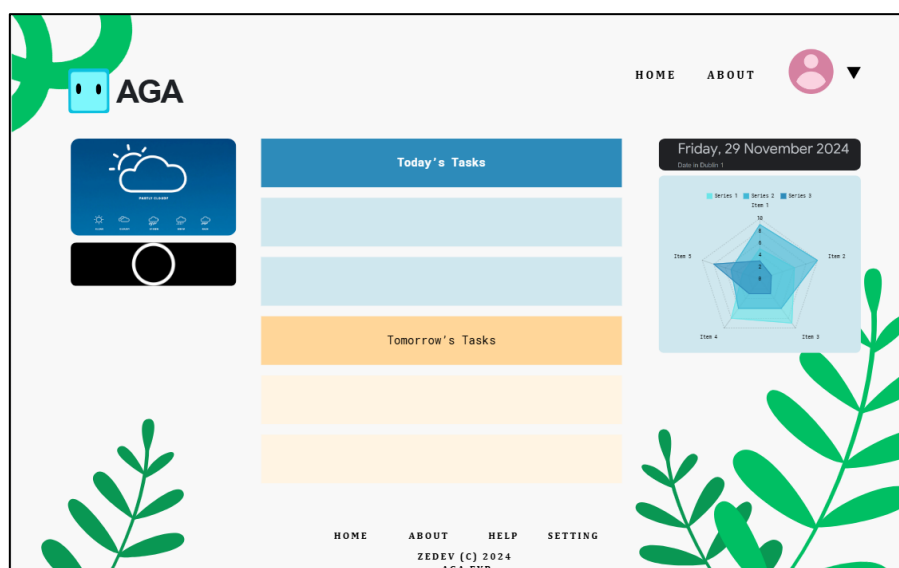


Figure 3.3.3 Web App GUI Main Page: Tools

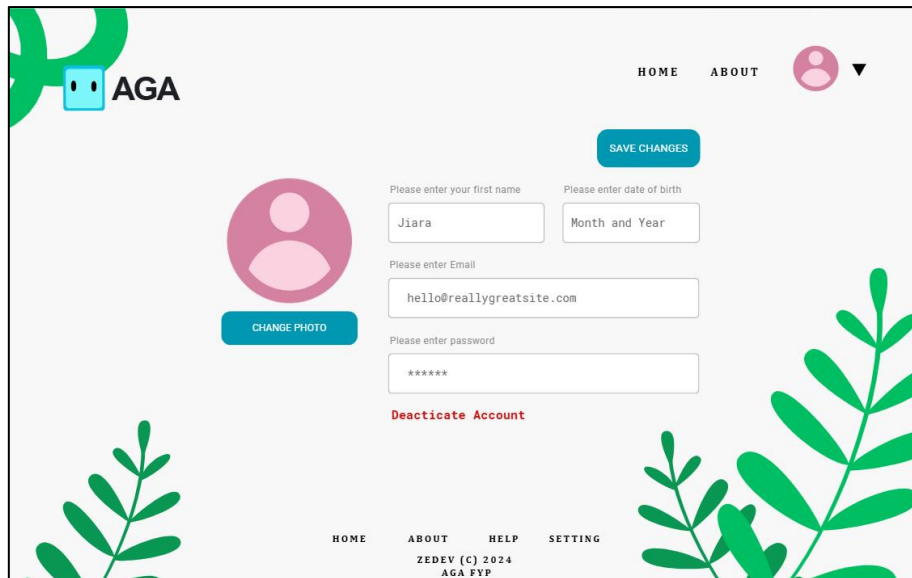


Figure 3.3.4 Web App GUI Profile/Setting Page

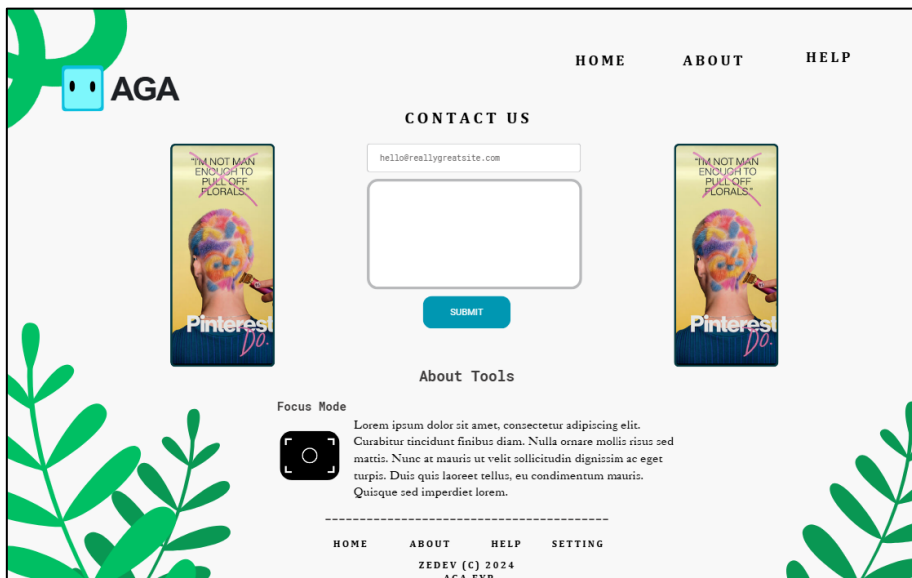


Figure 3.3.5 Web App GUI Contact Us Page

AGA Bot GUI Prototype

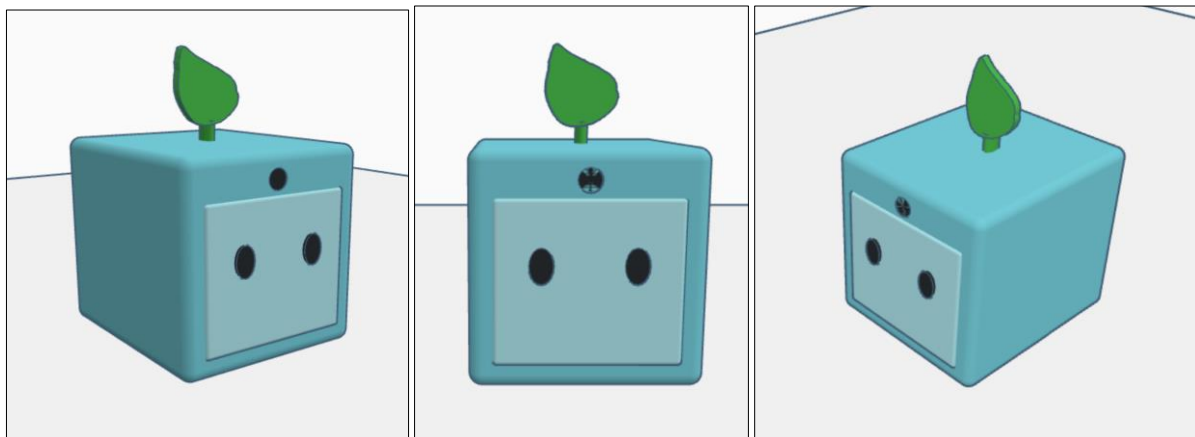


Figure 3.3.6 AGA Bot Using 3D Model

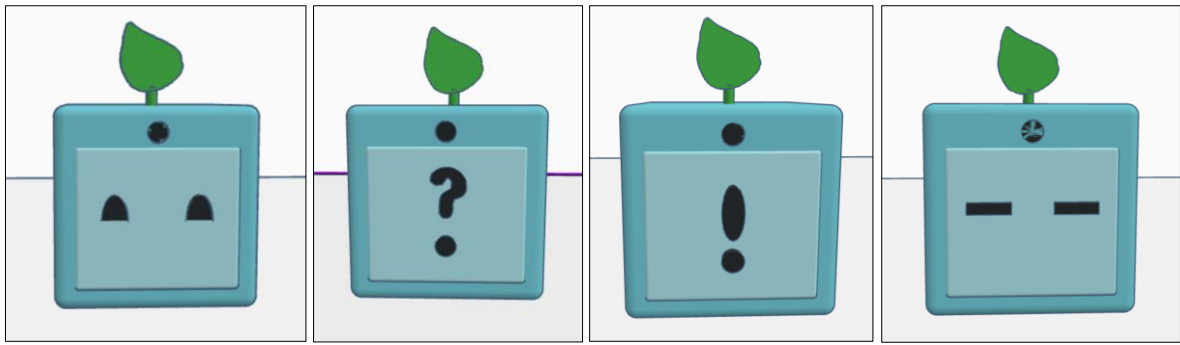


Figure 3.3.6 AGA Bot Expressions Using 3D Model

4. Testing and Evaluation

A key part of this evaluation involves a questionnaire distributed to individuals with ADHD. This feedback provides valuable insights into their needs, preferences, and challenges, allowing the system to be refined to better support its users. Additionally, this section highlights the challenges encountered during the implementation of the project's prototype, particularly in developing the Focus Mode and AGA's interface.

By evaluating what works effectively and identifying areas for improvement, this section provides a roadmap for refining the prototype and ensuring the final product meets user needs and expectations.

4.1. Understanding Users Needs

Questionnaire Form

ADHD and Daily Life Questionnaire
Understanding ADHD and Daily Challenges
In your own words, how would you describe ADHD and how it affects you personally?
What obstacles or challenges do you experience daily due to ADHD?
How do you typically overcome these obstacles or manage them?
Current Tools and Resources
What applications or activities do you currently use to help manage your daily routine?
What do you like most about the current services or tools you use?
What do you dislike about these services or tools?
Desired Features
What features are you looking for in apps or tools designed to support ADHD? <ul style="list-style-type: none">▪ Which features have been most helpful for you?▪ Which features have not worked or been effective for you?
Proposed Solution
Would you find a keychain device that consistently reminds you of your tasks and monitors your study/work progress helpful in managing ADHD? Why or why not?

Results of Questionnaire

ADHD and Daily Life Questionnaire
Understanding ADHD and Daily Challenges
<p>In your own words, how would you describe ADHD and how it affects you personally?</p> <ol style="list-style-type: none"> 1. For me it's a combination of inability to focus and issues with executive functioning. I also believe hyperactivity is one too though I think I lean on the inattentive side I do fidget a lot. 2. It is an inability to keep to a routine, a lack of motivation, and an inability to focus. I run out of time for everything I want to do, even just for living. 3. It's the reason it takes me three times as long as everyone else to do something, and the reason I have to work much harder than everyone else to get to the same level of skill as everyone else. 4. ADHD feels like a changing puzzle. The puzzle keeps changing so its hard to complete it. This is how it feels like it my life, where I think I know what I need to do and suddenly, my entirety wants to do something else. Its hard to be consistent.
<p>What obstacles or challenges do you experience daily due to ADHD?</p> <ol style="list-style-type: none"> 1. The biggest obstacles I face are taking care of myself so hygiene, remembering to brush my teeth hair, and managing to remember tasks I must do, finding motivation to do this tasks, and organizing and cleaning. Another one since I am a student is focusing in long lectures. I can't keep my attention no matter how hard I try sometimes. And the biggest one when it comes to homework is being able to start the assignment. 2. I can't get organized or complete necessary tasks in a very timely way. It sucks. 3. Getting started. Lately, I just seem to zone out for a long time until getting started becomes an emergency. That, and sleeping. I can't keep a sleep schedule to save my life. 4. I cant meet my deadlines unless there is pressure which also affects the quality of my performances on these tasks. I jump into different tasks due to the overwhelming tasks adding into my list unexpectedly which sometimes paralyses me into doing these tasks. I stress the same in different types of tasks even if its not important and do these over what is important as I don't distinguish them properly.
<p>How do you typically overcome these obstacles or manage them?</p> <ol style="list-style-type: none"> 1. The best things that work for me are external motivators. Like if someone's coming over or I make this promise to someone I will do it and they hold me accountable. I'm still figuring it out how to navigate this though. I also always try to set reminders on my phone to send me a notification if I need to remember something like an appointment. Another useful thing I've found for homework and studying is working at a time I'm least tired and in a quiet study room by myself with minimal noise and distractions. And access to snacks and water too so I don't get distracted and leave to find food. 2. I got medicated which helps a lot. I became better able to use a planner and reminders once I knew why I was struggling so much 3. I'm pretty old now, so I've just kinda learned how to tell what's going on, and then I talk myself through it. That, and fear. When I get to the point where something is now urgent, and hence fear inducing, I am good, and I can get moving. 4. I meditate – breathing exercise, etc. I write down what I need to do so I don't have to keep them constantly ticking in my head.

Current Tools and Resources

What applications or activities do you currently use to help manage your daily routine?

1. I don't know if I have much other than using reminders on my phone as of right now. I also have used todo lists and schedules to time when my classes are. But I do forget them a lot.
2. I use several digital calendars to keep track of my reminders because I can ask siri to create a calendar event really quickly (apple calender), use my outlook app to autocreate events when I read the email that the details come in, Use google calendar to see when my job has scheduled me (I just have a babysitting gig that the parent gives me a google calendar schedule)
I use onenote to keep a list that can be accessed on both my laptop and my phone. Its essential that I be able to add things when I think of them.
I use waterllama to remind me to drink water.
3. GDT, Freedom App, Kanbans, calenders, whiteboards, and lots of excercise.
4. Ive tried many different apps, mostly schedulers, lists, reminder types of apps. Unfortunately, I forget about them and never actually use them.

What do you like most about the current services or tools you use?

1. In terms of reminders on my phone I like that it'll notify me at that time and is pretty simple.
2. N/A
3. N/A
4. For example, I use the reminders app of iOS on my watch. It has time and date setters which I put on repetition, and I am reminded of the task on a weekly basis.

What do you dislike about these services or tools?

1. What I don't like is sometimes the effort to do it feels difficult for whatever reason. Or if my phone bugs and never sends a notification.
2. I dislike how I can't easily consolidate the calendars into one. Onenote requires a subscription to use. Waterllama is fine design-wise but I forget to use it.
3. They don't really work all the time, and I have to pay for them.
4. It requires so much effort to set up which then demotivates me as Ive already invested so much mental strength preparing it.

Desired Features

What features are you looking for in apps or tools designed to support ADHD?

Which features have been most helpful for you? Which features have not worked or been effective for you?

1. I don't use many applications. I genuinely have motivation at the start but then I forgot about them usually. I feel like maybe those apps I see online like ones that gamify tasks could be cool? I haven't used them in a while but my forgetfulness to use it is tricky. Maybe something cool could be things to really customize experiences. Like if I could put my own drawing or pictures as a theme or icon or something, it might make it more exciting. Or if they added funny things to it like funny sound effects you can add to make the app more entertaining. Funny messages maybe.
2. I love having widgets that I am forced to see when I scroll past them.

<ol style="list-style-type: none"> 3. Freedom because it locks me out of distractions. It doesn't always work anymore though, because I spent like three days once figuring out how to unlock it and defeat it. Whiteboards are the biggest help for me. 4. I want a product that is hard to miss, forget. Maybe a reward system? Something that will help my inconsistency.
Proposed Solution <p>Would you find a keychain device that consistently reminds you of your tasks and monitors your study/work progress helpful in managing ADHD? Why or why not?</p> <ol style="list-style-type: none"> 1. For me I don't. I've tried before but sometimes I just forgot why it's there or I'll procrastinate on it so much and then the keychain will blend in and I forgot. This happens with notifications too if I set one for every day it blends in and my brain tunes it out unfortunately. So they generally need to be novel and different each time for it to work. 2. Nope, I don't use my car everyday and am not likely to see it in a timely manner. I also frequently lose my keys because I only think about them when I need them. I don't even notice the keychains I have on my keys right now. 3. Probably not. I have a phone that can do that, and I ignore it most of the time anyway, until whatever it is becomes an emergency. 4. Yes and no, I may use it a lot at the start but just like my apple watch, there are days I forget about it for weeks on end

Findings

Referencing the questionnaire, it was evident that while individuals with ADHD appreciate tools designed to assist them, many existing solutions fail to address the core issues of forgetfulness, demotivation, and inconsistency. Features customisation and high visibility are in demand, while tools that are repetitive, complex, or require high mental effort are often abandoned.

Understanding ADHD and Daily Challenges	<p>ADHD Characteristics ADHD is often characterised by difficulty focusing, challenges with executive functioning, hyperactivity, and inconsistency in routines. Individuals frequently feel overwhelmed by tasks as their attention and focus shift constantly, resulting in frustration and inefficiency. Metaphors such as a "<i>changing puzzle</i>" capture the internal struggle, reflecting the unpredictability of focus and motivation experienced by those with ADHD.</p> <p>Common Challenges Individuals with ADHD often face significant challenges in initiating tasks, particularly in the absence of external pressure or deadlines. Difficulties with organisation, time management, and maintaining routines are common, leading to high levels of procrastination, zoning out, and unexpectedly switching between tasks. Overwhelming task lists can become paralyzing, causing individuals to focus on less important tasks while neglecting those that are more urgent.</p> <p>Methods of Coping External motivators, such as accountability partners or reminders, can be instrumental in helping individuals with ADHD stay on track. Techniques like writing down tasks, practising meditation, and using breathing exercises are</p>
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	<p>often effective for self-regulation. Additionally, digital tools such as planners, calendars, and notifications provide valuable support in remembering tasks, although their effectiveness can vary depending on individual needs and preferences.</p>
<p>Current Tools and Resources</p>	<p>The individuals often rely on a combination of tools to manage their tasks and routines, including phone reminders, digital calendars such as Apple or Google, and task management apps.</p> <p>Additionally, some individuals use specialised apps, such as Freedom to block distractions and Waterllama to encourage hydration.</p> <p>Positive Notes</p> <ul style="list-style-type: none"> ▪ Simple notifications and reminders were seen as effective for staying on top of tasks. ▪ Repetitive or consistent alerts are useful. ▪ Integration across multiple devices, such as phones and laptops, made tools easier to use. <p>Negative Notes</p> <ul style="list-style-type: none"> ▪ Discouragement on tools that require significant effort to set up. ▪ Notifications and reminders often become repetitive or easy to ignore over time, reducing impact. • Some apps require subscriptions or payments, which can be off-putting.
<p>Desired Features</p>	<p>What Users Wants:</p> <ul style="list-style-type: none"> ➔ High visibility Features such as widgets or unavoidable reminders to increase accountability. ➔ Customisation The ability to personalise apps, such as adding personal icons, images, or themes, to make them more appealing. ➔ Physical presence A product that is hard to forget or miss, such as a device always in sight, to ensure consistency. ➔ Reward systems Features that encourage progress by offering small, tangible incentives. <p>Avoid:</p> <ul style="list-style-type: none"> ▪ Overly complex setups that require significant effort to maintain. ▪ Tools or apps that don't adapt to a user's forgetfulness or inconsistency. ▪ Standard notifications or alerts that become repetitive and blend into the background.
<p>Proposed Solution (Keychain Device (AGA Bot))</p>	<p>The individuals expressed mixed reactions towards the idea of a keychain device, highlighting several concerns.</p> <p>Common issues included the tendency to forget or lose keys, making the device less reliable. Others worried that a keychain might blend into their environment and eventually be ignored. Others also expressed a preference</p>

	<p>for tools integrated into their phones or existing devices, as these are already part of their daily habits and more convenient to access.</p> <p>Alternative Preferences:</p> <ul style="list-style-type: none"> ▪ Some suggested that such a device would only work if it has a way to avoid being ignored. ▪ Suggestions included creating a highly visible, non-intrusive alternative that would encourage consistent use without overwhelming the user.
--	--

4.2. Prototype Testing

Challenges

Developing AGA's prototype, particularly the Focus Mode and its interface, posed several challenges. These obstacles primarily arose from selecting suitable libraries and methodologies to implement the required features effectively, combined with my limited experience in this area.

These challenges underscored the need for thorough research and adaptability during the implementation phase. By leveraging online resources, datasets, and tutorials, I was able to somewhat overcome these obstacles and progress toward developing AGA.

Focus Mode: Detecting User Concentration

Challenge

Initially, I lacked confidence in selecting appropriate libraries or understanding how to detect a user's concentration due to having no expertise in this area. The goal was to monitor the user's focus by tracking their eye movements and ensuring they are oriented toward the task by also detecting the location of their ears.

Solution

I discovered a relevant dataset on Kaggle and tutorials that provided step-by-step guidance on implementing eye-tracking and facial orientation detection. This allowed me to prototype the feature more effectively and gain a clearer direction for implementation.

AGA Bot: Facial Expressions for User Engagement

Challenge

Another significant challenge I faced was implementing dynamic facial expressions on the bot to improve user experience and create a sense of connection between the product and user. Initially, I struggled to find resources or libraries that could help me create and integrate facial expressions.

Solution

I identified a few potential libraries for facial expression rendering but found that many lacked the specific features I needed. I am exploring options to either use existing libraries or, if necessary, draw and program the expressions from scratch to ensure they align with the bot's functionality.

Focus Mode Testing Plan 01

Testing Plan 01	Focus Mode Feature
<p>Objective</p> <p>To evaluate the functionality and effectiveness of the Focus Mode feature, ensuring it accurately detects user focus, alerts for loss of concentration, and provides break recommendations after extended focus.</p>	

Testing Scenarios	
1	Focus Detection
Test Case	Verify that the bot accurately detects the user's eyes and ears while in Focus Mode.
Expected Outcome	The bot successfully identifies the user's presence and confirms they are working/studying. (<i>Turn Green</i>)
2	Loss of Focus Detection
Test Case	Scenario where the user looks away or remains still for an extended period.
Expected Outcome	The bot detects the loss of focus and turns red to alert the user.
3	Break Recommendation
Test Case	Users remain focused for 30 minutes or more.
Expected Outcome	The bot recommends a break by turning blue and displaying " <i>break</i> ".
4	Environmental Challenges
Test Case	Evaluate the bot's focus detection in different lighting conditions and with potential distractions in the background.
Expected Outcome	The bot consistently identifies focus or loss of focus, regardless of environmental factors.

Bot Facial Expressions Testing Plan 02

Testing Plan 02 Bot Facial Expressions Feature									
Objective To assess the implementation of facial expressions on the bot, ensuring they improve user engagement and enhance the overall experience when interacting with the bot.									
Testing Scenarios									
1	Appropriate expressions on different cases								
Test Case	Show that for each case, expression is showed as listed: <table border="1" data-bbox="470 1355 1385 1512"> <tr> <td>Happy Expression</td><td>Task completed</td></tr> <tr> <td>Neutral Expression</td><td>Idle state or waiting for input</td></tr> <tr> <td>Sad Expression</td><td>Error</td></tr> <tr> <td>Excited Expression</td><td>Encouragement during focus mode</td></tr> </table>	Happy Expression	Task completed	Neutral Expression	Idle state or waiting for input	Sad Expression	Error	Excited Expression	Encouragement during focus mode
Happy Expression	Task completed								
Neutral Expression	Idle state or waiting for input								
Sad Expression	Error								
Excited Expression	Encouragement during focus mode								

5. Prototype Development

In this section, I will present code snippets developed during the interim phase, highlighting key functionalities and progress made in the implementation of AGA.

5.1. Focus Mode

Focus Mode is main feature of AGA, designed to help users achieve a balance between their responsibilities and overall well-being. This feature aims to keep users focused on their tasks while also providing gentle reminders to take breaks when they become hyper fixated. This is essential for promoting better wellness management.

The main components of this feature include the ability to detect the user, determine their focus level, and respond appropriately when the user loses focus or becomes hyper focused.

Face Detection

This code implements a Face Detection system using dlib and OpenCV to monitor a user's facial movements and concentration. It detects key facial features, such as the eyes and head position, to assess whether the user is focused or distracted. By calculating the *Eye Aspect Ratio* (EAR) and tracking head stability, the system determines if the user is looking at the screen and if their face and body are stable. Based on this information, the system adjusts a bot's expression to indicate whether the user is focused or distracted.

```
if eyes_detected == 2:
    left_ear = self.get_eye_aspect_ratio(left_eye)
    right_ear = self.get_eye_aspect_ratio(right_eye)
    avg_ear = (left_ear + right_ear) / 2.0

    if avg_ear >= EAR_THRESHOLD:
        user_looking = True
        self.eye_frame_count = 0
    else:
        self.eye_frame_count += 1
```

Figure 5.1.A Calculating EAR

This section of the code is responsible for detecting whether the user is looking at the screen by calculating the EAR for both eyes – it measures the ratio between certain distances on the eye and is used to detect eye openness. If the avg_ear is below the threshold, which suggests the user might be blinking or distracted, the *eye_frame_count* is incremented to track how long the user has been distracted. This process helps the system assess the user's attention and adjust the bot's expressions accordingly.

```
# check stability for face and head/body
if face_features is not None and self.is_stable(face_features, self.last_face_features,
                                                self.stability_tolerance):
    self.face_stable_frame_count += 1
else:
    self.face_stable_frame_count = 0 # reset if facelandmarks are not stable/detected
```

Figure 5.1.B Calculating Stability

The code monitors whether the position of the face or head has shifted significantly between consecutive frames. If either moves beyond the threshold, it is considered unstable, and the frame

count for stability is reset. This check ensures that the system can differentiate between intentional movements

```
self.last_face_features = face_features
self.last_head_position = head_position
```

Figure 5.1.C Updating Last Positions of Individual

This part ensures that the system can track continuous changes in face and head position over time. Each frame's result depends on the previous frame's face/head position, creating a continuous assessment of user stability.

```
# determine if user is stable or if distracted (alert [ ! ])
is_both_stable = (
    face_stable >= self.face_detector.stability_threshold and body_stable >= self.face_detector.stability_threshold
)
is_body_stable = body_stable >= self.face_detector.stability_threshold
is_eye_distracted = eyes_detected < 2 or self.face_detector.eye_frame_count >= CONSECUTIVE_FRAMES
```

Figure 5.1.D Determine User's Focus Level (Concentrated/Stable or Distracted)

```
if is_both_stable or is_body_stable or is_eye_distracted:
    self.bot_expression.expression = "alert"
    self.start_time = time.time()

elif user_looking and eyes_detected == 2:
    self.focused_expression()
```

Figure 5.1.E Provides Feedback to the user using Bot Expressions

This logic helps ensure that the system accurately detects user focus and provides feedback, such as alerting the user to refocus when instability or distraction is detected. In Figure 5.1.E, it sets the bot to show an alert if it detects the user is either distracted - *based on eye movement* - or their body/facial position is unstable. This is a way to encourage the user to refocus or remain stable.

5.2 AGA's Facial Expressions

The primary objective of implementing facial expressions on AGA is to enhance user experience by creating a sense of connection and companionship. By creating a bond between the user and the bot, it encourages users to feel more comfortable and open when interacting with AGA.

This openness is important, as it ensures users are more likely to keep AGA nearby and consider the suggestions it provides, therefore, improving its effectiveness in supporting their productivity and well-being.

Expressions

Happy	Task completed or triggered every N minute
Neutral	Idle state or waiting for input
Alert	When User loses focus, it prompts an alert face
Break	When User is in focus for N minutes, it prompts a message for break

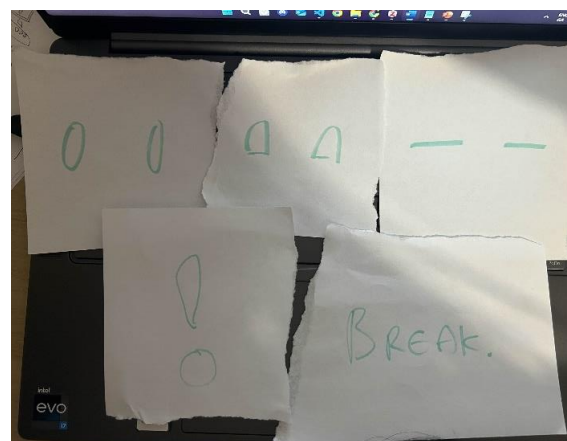


Figure 5.2.A Face Expressions Prototype

```
elif self.expression == "neutral":
    # oval eyes [ 0 0 ]
    pygame.draw.ellipse(self.screen, EYE_COLOUR, (140, 160, 37, 47))
    pygame.draw.ellipse(self.screen, EYE_COLOUR, (228, 158, 35, 45))
```

Figure 5.2.B Neutral Expression of AGA (Base Face)

```
if self.expression == "happy": # Idea: (0 + _ = D)
    # left eye
    pygame.draw.ellipse(self.screen, EYE_COLOUR, (140, 160, 37, 47)) # half oval
    pygame.draw.rect(self.screen, BACKGROUND_COLOUR, (140, 182, 37, 28)) # flat bottom

    # right eye
    pygame.draw.ellipse(self.screen, EYE_COLOUR, (228, 158, 35, 45)) # half oval
    pygame.draw.rect(self.screen, BACKGROUND_COLOUR, (228, 180, 35, 28)) # flat bottom
```

Figure 5.2.C Building the Happy Expression of AGA

```
elif self.expression == "attitude":
    # line eyes [ - - ]
    pygame.draw.line(self.screen, EYE_COLOUR, (130, 180), (185, 180))
    pygame.draw.line(self.screen, EYE_COLOUR, (215, 180), (270, 180))
```

Figure 5.2.E Building Attitude Expression of AGA

```
elif self.expression == "break":
    # No face but [ Break? ] to alert user*
    # create font object, add text in white and center text
    font = pygame.font.SysFont(None, 60) # font object
    text = font.render("Break?", True, (255, 255, 255))
    text_rect = text.get_rect(center=(WIDTH // 2, HEIGHT // 2))

    self.screen.blit(text, text_rect)
```

Figure 5.2.B Building Break Expression of AGA

```
elif self.expression == "alert":
    # No face but [ ! ] to alert user*
    # find center position
    center_x, center_y = 200, 200

    # draw exclamation mark for alert
    bar_width, bar_height = 20, 60
    bar_x = center_x - bar_width // 2
    bar_y = center_y - bar_height

    pygame.draw.rect(
        self.screen,
        (255, 255, 255),
        (bar_x, bar_y, bar_width, bar_height),
        border_radius = 10
    )

    dot_radius = 10
    dot_x, dot_y = center_x, center_y +
    pygame.draw.circle(
        self.screen,
        (255, 255, 255),
        (dot_x, dot_y),
        dot_radius
    )
```

Figure 5.2.D Building Alert Expression of AGA

The variety of expressions, from happy to alert, allows AGA to offer real-time feedback that adapts to the focus state, enhancing its role as an interactive and responsive companion.

6. Project Management

This section of the report provides an overview of the project management approach utilised for this project. It covers the *project plan - milestone roadmap*, *development methodology and task distribution methods - supervisor and team engagement strategies*, as well as *risk management practices*.

Each component is discussed to highlight how structured planning, communication, and proactive risk mitigation were applied to achieve project objectives effectively.

6.1. Project Plan

Milestones & Roadmap

The project plan is divided into four quarters, with each semester consisting of two quarters. The first semester focuses on completing the development of the product, while the second semester is dedicated to the refinement of the product.

Milestone	Start Date	End Date
Feasibility Research, Design & Project Management	Nov 04, 2024	Nov 08, 2024*
Prototype & Review (Testing)	Nov 09, 2024	Nov 16, 2024
Code Implementation	Nov 17, 2024	Dec 14, 2024
Testing	Dec 15, 2024	Dec 21, 2024

Figure 6.1.1.A Milestones First Semester

Milestone	Start Date	End Date
Product Review	Jan 05, 2025	Jan 18, 2025
Refinement 01	Jan 19, 2025	Feb 08, 2025
Refinement 02	Feb 09, 2025	Feb 28, 2025
Review & Testing (FINAL)	Mar 01, 2025	Mar 15, 2025
Documentation & Project Launch	Mar 16, 2025	Mar 29, 2025
Official Website Development (One-Page)	Mar 30, 2025	Apr 05, 2025
Project Submission	Apr 06, 2025	Apr 12, 2025
Project Completion	Apr 13, 2025	Apr 19, 2025

Figure 6.1.1.B Milestones Second Semester

The project roadmap is automatically generated in GitHub when creating iterations. By setting up these iterations, GitHub organises the tasks, deadlines, and progress into a clear, visual roadmap. This automated roadmap provides an overview of the project's timeline, making it easy to track each phase's progress and ensuring that the project stays aligned with its planned schedule.

Find the roadmap on AGA's Project at <https://github.com/users/vedez/projects/2>.

Task Distribution

Tasks are organised by priority and distributed across the following stages to maintain a streamlined workflow.

Find the backlog of tasks on AGA's Project at <https://github.com/users/vedez/projects/2/views/1>.

❖ To Do

This stage includes all pending tasks, organised by labels such as *Stories*, *Tasks*, and *Bugs*. Each item represents a possible issue or feature for the project. Uncompleted tasks stay in the backlog until allocated catch-up time.

❖ In Progress

Tasks are tackled one at a time to help maintain focus and prevent overwhelming scenarios. Stories are broken down into manageable tasks, which are completed individually to maintain a clear path from "to do" to "done."

❖ Review & Testing

Completed features are submitted in a different branch, where they undergo review and testing. Once a feature meets standards, it is merged into the main project branch, reducing bugs and maintaining quality.

❖ Done

Tasks are marked as "done" once they meet all requirements and quality standards. In this project, the definition of "done" means that the feature fulfils all specified requirements and has little to no bugs. Minor bugs that do not significantly impact the project can be logged as separate bug tasks to be addressed during review or allocated catch-up time.

6.2. Supervisor Engagement

Dr. Bojan Božić is an Assistant Lecturer in Computer Science at TU Dublin with extensive expertise in Semantic Web, Machine Learning, and Data Science. He will be supervising the development of my fourth-year project, AGA.

More information could be found at <https://www.tudublin.ie/explore/faculties-and-schools/computing-digital-data/school-of-computer-science/people/academic-staff/bojanbozic.php>.

Meeting Availability

Tuesday	14:00 – 15:00
Wednesday	11:00 – 15:00
Thursday	11:00 – 15:00

Types of Meeting

❖ Catch Up

- A quick catch-up meeting regarding what has been completed during the week. This could either be delivered via on-site/online meeting or re-cap document sent via email.
- Time duration: 15 minutes max.

❖ Review

- This meeting reviews bigger accomplishments - *features, testing, etc...* - to discuss about what has been completed, possible changes to apply, and general feedback of these tasks.
- Time duration: 30 minutes max.

❖ Retrospective

- This meeting opens feedback regarding communication and the handling of the project if any aspects need to be changed or continued. This is important to ensure morale and strengthens communication of the team.

6.3. Risk Management

Technical Risks

➤ Software Bugs and Errors

Mitigated through regular testing and continuous review of the issue board. Non-functioning features should be flagged immediately and either fixed within the current iteration or added to the backlog for scheduled review and correction.

➤ Version Control

Use branches to manage different versions of the code, merging only after code has passed review to reduce bugs in the main project. Labelling “done” in the definition stated in 6.1.3 *Task Distribution*.

➤ **Security and Authorisation**

Implement Object-Oriented Programming (OOP) principles and assign appropriate authorisation levels to ensure secure, manageable code.

User Risks

➤ **User Satisfaction and UX Failures**

Addressed through dedicated UX testing cases that prioritise user feedback to enhance usability. This is the top priority during the second semester for code implementation.

➤ **User Communication**

Engaging with users to understand their needs is essential, focusing on features that benefit their experience and usability of the application.

Project Management

➤ **Time Constraints**

Each task or story is estimated for time, with allowances for unexpected delays by incorporating buffer time into the schedule.

➤ **Scope Creep**

Clearly define the project scope, prioritising core features. Additional requests or features are added to the backlog to address only if time allows, ensuring focus and avoiding overloading tasks.

➤ **Freeze Point**

Establish a “*freeze point*” where no new features or changes can be added, solidifying the final scope for efficient completion.

Legal and Regulatory Risks

➤ **Data Privacy Compliance**

Ensure all user data handling complies with GDPR and other relevant data privacy laws.

➤ **Age Restrictions and Safety**

Consider age restrictions, ensuring that the product is safe and accessible for younger audiences. Additional laws regarding online safety and accessibility may also be reviewed.

Steps for Effective Risk Management

1. **Risk Identification:** List potential risks across technical, user, project management, and regulatory areas.
2. **Risk Assessment:** Evaluate the likelihood and impact of each risk.
3. **Risk Prioritisation:** Prioritise high-risk items that have both high likelihood and high impact.
4. **Mitigation Planning:** Develop strategies to manage risks, such as additional testing phases.

6.4. Project Plan for Next Phase

As the interim phase ends, I now have a clearer understanding of the priorities and focus areas required for the next stage of development. The upcoming phase will involve a significant push to implement the core framework of the project, ensuring that production aligns with the initial project plan drafted earlier in the year.

During winter break, the primary goal will be to complete the implementation phase for key features such as the Task Setter, Mood Log, and Weather API, integrating these functionalities into the web application. Additionally, I will be constructing the physical AGA product, assembling the hardware components scheduled to arrive during this timeframe.

This stage is crucial for laying the groundwork for both the web application and the bot, with the focus for the next year on refining the project to enhance user experience.

Plans and Future Work (Future Scope)

The next phase of the project focuses on completing the technical implementation and integrating all features into a cohesive system. The goal is to complete the implementation phase of both the web application and the bot by the end of 2024 which allows next year's focus on refining the project through code and project review and usability testing.

The following steps outline the future scope for the end of the year:

Feature Completion and Integration	Finalise implementation for: <div><input type="checkbox"/> Focus Mode <input type="checkbox"/> Mood Log <input type="checkbox"/> Task Setter <input type="checkbox"/> Weather API <input type="checkbox"/> Profile Authentication</div> Integrate these features into a fully functional web application that connects the front end, back-end, and database systems.
Web Application Development	<ul style="list-style-type: none">▪ Develop the web application UI, ensuring all features are connected.▪ Develop the front end and back-end systems to support real-time functionality and data synchronisation.
Building AGA (Bot)	<ul style="list-style-type: none">▪ Assemble AGA with specific ordered hardware components - <i>Raspberry Pi, sensors, display and others.</i>▪ Connect the bot to the database, enabling it to interact with users and features such as Focus Mode directly through the hardware.

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