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Home

Project Overview: ChatGPT and NAO Robot



Image source: https://github.com/CHRI-Lab/cowriter_letter_learning

Composed of a set of ROS nodes that facilitate the user interaction with a robot, the CoWriter project is designed for children to teach a social robot handwriting. Nao is an autonomous, programmable humanoid robot and has been used for demonstration purposes for this project. Last semester, three different teams from the Software Project subject (COMP90082) took over this project with goals to 1) update the CoWriter project from Python2 to Python3 and 2) integrate ChatGPT to enable NAO robot to have conversations with children. Currently, these projects are each deployed in different environments and have achieved slightly different outcomes.

This project aims to 1) merge the previous projects in one unified environment, 2) add further enhancements to the CoWriter project and NAO's conversation capabilities, and 3) implement a logging and annotation module for data management purposes.

Team NA-Redback

| Name (Preferred Name) | Role | Contact | Bio |
|-----------------------|---------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wafa Johal | Client | wafa.johal@unimelb.edu.au | Dr Wafa Johal is a senior lecturer at the School of Computing & Information Systems, Faculty of Engineering and Information Technology, University of Melbourne. Her research focuses on human-robot/computer interaction and intelligent and autonomous systems. |
| Sebastian Bobadilla | Supervisor | bobadillacha@unimelb.edu.au | Sebastian is part of the teaching team for COMP90082 Software Project subject and is a supervisor for the NA-Redback team who oversees the progress of this project. |
| Eunji Kim (Rachel) | Product Owner, Dev Member | kimek@student.unimelb.edu.au | Rachel is a final-year master's student in IT specialising in AI at the University of Melbourne. Her interests lie in data analytics, natural language processing, and human-computer interaction. |
| Difan Wu | Scrum Master, Dev Member | difanw@student.unimelb.edu.au | Difan Wu is a Master of IT - Artificial Intelligence student at the University of Melbourne. Originally trained as an architect, his innate curiosity, determination and adaptability led him to embrace a new challenge in the world of IT. Currently, he is focusing on large data processing, machine learning and computer vision. |

Recent space activity



Chien-Pu LIN

Background
Description updated 3 minutes ago • [view change](#)



Difan WU

Sprint1:Inception
Planning updated 3 minutes ago • [view change](#)



EUNJI KIM

Background
Description updated 16 minutes ago • [view change](#)



Difan WU

Personas updated 20 minutes ago • [view change](#)



Yangchen Shen

Personas updated 22 minutes ago • [view change](#)

Space contributors

- Chien-Pu LIN (3 minutes ago)
- Difan WU (3 minutes ago)
- EUNJI KIM (16 minutes ago)
- Yangchen Shen (22 minutes ago)
- Aurelien Plaire (27 minutes ago)
- ...

| | | | |
|----------------------|--------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aurelien Plaire | Tech Lead | aulaire@student.unimelb.edu.au | Aurélien is a former general engineering student at CentraleSupélec, completing a double degree at the University of Melbourne (Master of IT - Computing). His interests lie in data processing and management, and software development. |
| Chien-Pu Lin (Jeff) | Test Lead | chienspu.lin@student.unimelb.edu.au | Jeff is a Master of IT student, specializing in AI, at the University of Melbourne. His interests span AI, machine learning, cloud computing and robotics. He is eager to dive into cutting-edge technologies and innovations. |
| Yangchen Shen (Shen) | Quality Lead | yangchens2@student.unimelb.edu.au | Shen is a Master of IT student at the University of Melbourne. His interests lie in natural language processing, data processing and management, and software development. |

Links to our Project

- [Trello board](#)
- [Github repository](#)

Background Description

Project Background



Image source: https://github.com/CHRI-Lab/cowriter_letter_learning

Composed of a set of ROS nodes that facilitate the user interaction with a robot, the CoWriter project is designed for children to teach a social robot handwriting. Nao is an autonomous, programmable humanoid robot and has been used for demonstration purposes for this project. Last semester, three different teams from the Software Project subject (COMP90082) took over this project with goals to 1) update the CoWriter project from Python2 to Python3 and 2) integrate ChatGPT to enable NAO robot to have conversations with children. Currently, these projects are each deployed in different environments and have achieved slightly different outcomes.

Project Overview

This project, "ChatGPT and NAO Robot (Code: NA)", aims to **1) merge previous projects in one unified environment, 2) add further enhancements to the CoWriter project and NAO's conversation capabilities, and 3) implement a logging and annotation module for data management purposes.**

Client Goals

Our client is **Dr Wafa Johal**, who is a senior lecturer at the School of Computing & Information Systems, Faculty of Engineering and Information Technology, University of Melbourne. Her research focuses on human-robot/computer interaction and intelligent and autonomous systems. Through the CoWriter Project, she aims to examine the application of the learning by teaching on motivating children to practice their handwriting skills accompanied with a humanoid robot (NAO).

The client goals can be largely divided into four:

1. Integration of previous projects in a single repository
2. Improvement of the CoWriter software
 - Optimise the learning process by being able to identify letters the children are struggling with and control the difficulty accordingly
 - Make the UI more user-friendly by integrating kids-friendly illustrations
3. Refinement of conversation using ChatGPT
 - Ensure that the conversation stays child-friendly

- Enhance the interaction by incorporating motions/gestures to NAO robot during conversation

4. Upgrade ROSbag data management

- Implement logging and annotation module

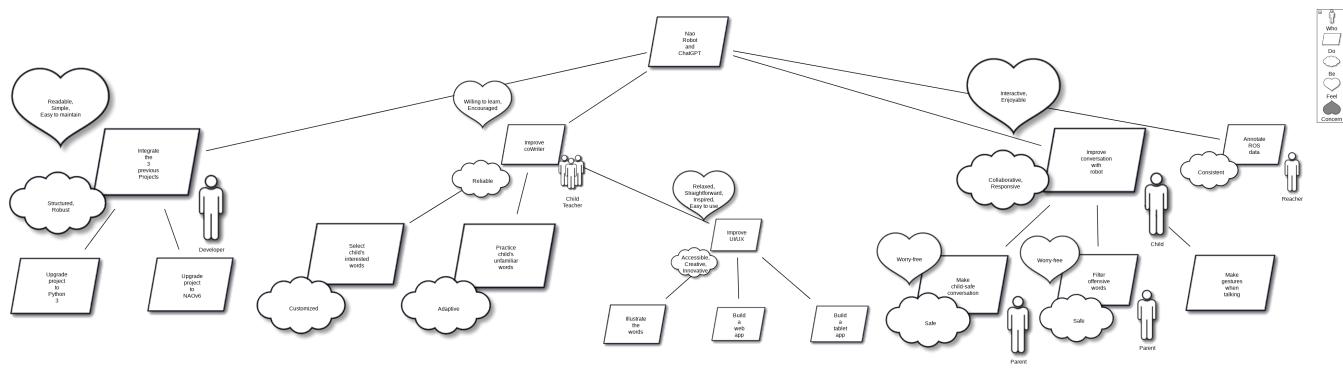
Stakeholders

| Role | Internal/External | Engagement | Interests |
|------------------|-------------------|------------|-----------|
| Client | Internal | High | High |
| Development Team | Internal | High | High |
| Children | External | High | Medium |
| Researchers | External | Medium | Medium |
| Parents | External | Low | High |

DO-BE-FEEL

| DO | BE | FEEL | WHO |
|-----------------------------------|---------------|------------------|-------------|
| Upgrade project to Python 3 | Robust | Simple | Children |
| Integrate the 3 previous projects | Structured | Readable | Developers |
| Improve coWriter | Reliable | Willing to learn | Parents |
| Select child's interested words | Customized | Encouraged | Researchers |
| Upgrade project to NAOv6 | Innovative | Easy to maintain | Teachers |
| Practice child's unfamiliar words | Adaptive | Interactive | |
| Improve conversation with robot | Collaborative | Relaxed | |
| Make child-safe conversation | Safe | Worry-free | |
| Filter offensive words | Responsive | Enjoyable | |
| Make gestures when talking | Accessible | Straightforward | |
| Improve UI/UX | Creative | Inspired | |
| Illustrate the words | Consistent | Easy to use | |
| Build a web app | | | |
| Build a mobile app | | | |
| Annotate ROS data | | | |

Goal Model



Link: <https://momo-comp90082.eresearch.unimelb.edu.au>

Development Environment

Software Processes Management

The following technologies will be used by the team to support the software development processes:

- **Trello** to track and manage development tasks ([our Trello board](#));
- **Confluence** to store all the useful resources linked with the project (meeting minutes, documentation ...);
- **Slack** as an external communication tool to interact with our supervisors and clients (the team decided to use **Discord** for internal communication) ;
- **Zoom** to host meetings with our supervisors and clients ;
- **GitHub** as a DevOps tool to update and manage the source code of the project ([our GitHub repository](#)).

Technologies

The work we will conduct this semester constitutes the developments of three projects which were conducted last semester ([BlueRing](#), [BoxJelly](#) and [RedBac](#)). Following in from these three projects, we propose to use the same stack to develop our new source code on the top of the existing one. Indeed, the technologies used last semester are (almost) the same for each team.

The main part of the stack will be composed of:

- Linux (**Ubuntu**) for the operating system ;
- **ROS** (Robot Operating System) used for communication the robot and the Python controlling module ;
- **Python3** to develop the new functionalities for the robot.

Nevertheless, even though the objectives were similar for each of the previous teams, we noted differences in the versions of the softwares used and in the installation instructions. This is why **containerizing applications**, such as Docker, could represent a powerful tool to set a single and stable coding environment.

This approach will have two main advantages:

- No compatibility issues will be encountered by the team during the development phase (the code developed by one team member will be executable by any other) ;
- The environment will already be defined for the future teams involved on this project.

Coding Standards

The Git branching model used for this project will be [Gitflow Workflow](#).

The general idea of this workflow is to work with 2 principal branches:

- *main* which will host the tested and finalised source code ;
- *develop* which will serve as a feature integration branch to test new releases before merging them on main.

More information about this workflow is available [here](#).

Most of our code development will be Python, so the coding standards used for this language will be the following:

- [PEP8](#) for all the coding conventions (ex: syntax checking, best practices) ;
- [Black](#) for code formatting automation (ex: maximum character number per line).

To ensure that the code pushed is consistent with the chosen Python standards, a [GitHub Action](#) has been set on the [repository](#).

At each commit, a pipeline will be triggered. It will execute a command (module [Flake8](#)) to check if each specified Python file complies with PEP8's rules.

If the pipeline should fail, it would mean some changes have to be made to ensure the consistency of the source code.

Requirements

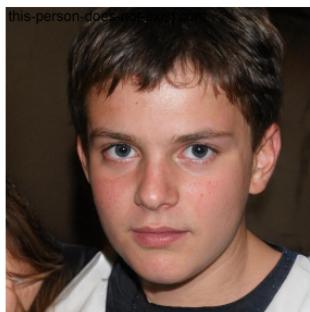
User Stories

| Epic | ID | User Story | | | Priority | Story Point (0-89) | Justification | ChatGPT Generated |
|-------------------------------------------|----|------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Integration of previous projects | 1 | As a client, | I want the entire developed code to run under one unified environment | so that there are no compatibility issues between each chunk of code. | Must | 16 | This part is crucial for delivering a reliable and robust end product | No |
| | 2 | As a client, | I want the code to be merged in a single repository | so that it's easy to do version control and monitoring. | Must | 58 | This is of the highest priority as it's the first step to be done to get the project started | No |
| | 3 | As a client, | I want the code to be well organized, documented and meaningful, | so that joining the project as a new developer will not require useless efforts. | Must | 7 | Since there will be a big chunks of codes to merge, it is crucial to organise it in a structured manner and document accordingly | No |
| Improvement of conversation using ChatGPT | 4 | As a child, | I want the robot to associate a human gesture to its conversation, | so that I would feel like talking to a real person. | Could | 29 | This is an optional feature that will make the interaction between kids and robot more fun and immersive | No |
| | 5 | As a parent, | I want the robot to have a conversation with my kids in a child-friendly and safe manner | so that my child's interaction stays positive and free from inappropriate content. | Must | 29 | Ensuring a child-friendly and safe conversation is essential for the children's wellbeing, and keeping them away from potential harm and negative influence | No |
| Improvement of CoWriter | 6 | As a parent, | I want my kids to be able to practice their struggling letters | so that the learning process can be more engaging. | Must | 38 | This will be a significant upgrade to the CoWriter software and will play a key role to make the writing practice more personalised and effective | No |
| | 7 | As a parent, | I want to add more child-friendly interface (UI) elements to the WebApp | so it helps kids to easily understand and remember the words | Could | 23 | This is an extra feature that will potentially help with children's vocabulary retention. This is yet remains as a "Could" priority as it's only a supplementary feature and not of an immediate critical need. | No |
| | 8 | As a child, | I want to be able to select the domain I'm interested in | so that the learning becomes more fun and engaging | Could | 24 | This is another optional feature that can contribute to more motivating and personalised learning environment for children | No |
| Upgrade ROSbag data management | 9 | As a researcher, | I want to have access to the data collected from the robot | so that I can have more insight on the human-robot interaction | Should | 27 | This feature will provide researchers with valuable insight on human-robot interaction dynamics and behaviours, possibly contributing to the future advancements in the field of robotics | No |
| | 10 | As a researcher, | I want to be able to log relevant information during experiments | so that more data could be used to improve robot's performances | Should | 24 | This will be a valuable asset for driving the data-driven performance improvements to the robot's capabilities | No |

Personas

| Persona | Titles | Personality | Goals |
|---------|------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alex | Student | <ul style="list-style-type: none"> • Introvert • Creative • Fickle • Curious | <ul style="list-style-type: none"> • Fun and Play • Exploration • Positive Reinforcement |
| Lily | Student | <ul style="list-style-type: none"> • Extrovert • Analytical • Fickle • Passive | <ul style="list-style-type: none"> • Variety and Flexibility • Positive Reinforcement • Independence |
| Emily | Parent | <ul style="list-style-type: none"> • Introvert • Thinking • Intuition • Perceiving | <ul style="list-style-type: none"> • Convenience • Engaging Activities • Quality Education • Technology Integration |
| Olivia | Researcher | <ul style="list-style-type: none"> • Extrovert • Creative • Loyal • Active | <ul style="list-style-type: none"> • Cutting-Edge Tools • Effective Learning Solutions • Data-Driven Insights |
| Alan | Researcher | <ul style="list-style-type: none"> • Extrovert • Creative • Easy • Active | <ul style="list-style-type: none"> • Real-World Application • Adaptive Learning • Data-Driven Insight |

Alex



"Explore, Play, and Write Your Way to Success with Our Robot Learning Companion!"

Age: 6
Work: Student
Family: Father and Mother
Location: Perth
Character: Active

Organized Practical
Protective Hardworking

Bio

Alex is a 6-year-old boy with a curious and energetic personality. He is currently in kindergarten and is at the stage of learning to write his letters. Alex loves to explore the world around him and is fascinated by all things that move, make noise, and light up. He enjoys spending time with his friends, playing games, and drawing.

Personality



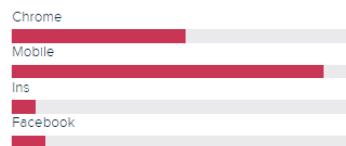
Goals

- **Fun and Play:** Alex values activities that are fun, interactive, and capture his imagination.
- **Exploration:** He is naturally curious and loves to try new things, especially if they involve hands-on experiences.
- **Positive Reinforcement:** He thrives on positive feedback and encouragement, which motivates him to keep trying and learning.

Needs & Pain Points

- **Engaging Learning:** Alex is looking for ways to learn that feel like play, where he can have fun while acquiring new skills.
- **Visual and Interactive:** He is drawn to activities that are visually appealing and involve interactive elements like touchscreens or buttons.
- **Encouragement:** He benefits from tools that provide positive reinforcement and celebrate his achievements.

Preferred Channels



Lily

Age: 8
Work: Student
Family: Parent
Location: Seattle, WA

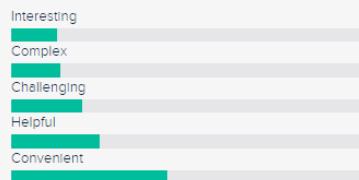
Bio

Lily is a 8-year-old girl. She has a vibrant and imaginative personality and enjoys spending time exploring creative activities and hobbies. Lily is known for her artistic talents and has a natural ability to come up with unique and imaginative ideas. However, when it comes to traditional studies and academic subjects, Lily often finds it challenging to focus and maintain her interest.

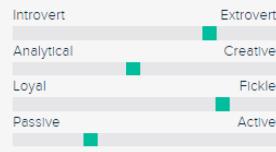
Pain Points & Challenge

- Lack of Focus:** Lily often struggles to concentrate on one task for an extended period, leading to difficulty in completing assignments or studying for tests.
- Traditional Study Methods:** She becomes easily bored with traditional study methods that involve reading textbooks or memorizing information.
- Frustration with Routine:** Lily finds it frustrating to stick to rigid schedules or routines, as they can dampen her creative spirit and sense of exploration.
- Perceived Failure:** Lily's low tolerance for activities that she doesn't enjoy can lead to feelings of failure or inadequacy when it comes to academics.

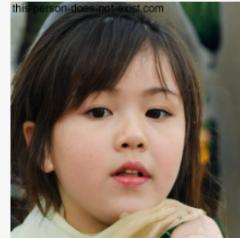
Motivation



Personality



Naughty Unlearning
Independence



"Unlock Your Creative Power: Learning Made Engaging, Personal, and Fun!"

Emily



Busy Patient High hopes for her child

Bio

Emily is a 35-year-old parent of two children, aged 5 and 7. She works as a marketing manager for a tech company and is passionate about providing her children with the best learning experiences. Emily is dedicated to finding innovative and engaging ways to support her children's education and development.

"Empowering my children's learning journey through interactive and personalized experiences is the key to unlocking their full potential."

Name: **Emily**
Gender: **Female**
Age: **35**
Work: **Marketing Manager**
Family: **Married, kids**
Location: **MEL, VIC**
Income: **5000AUD per month**

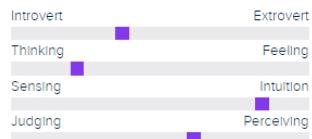
Needs & Pain points

- Educational Support:** Emily is looking for effective ways to help her children learn essential skills, such as writing letters, outside of the traditional classroom environment.
- Engagement:** She wants her children to be excited about learning and is seeking activities that can capture their attention and maintain their interest.
- Customization:** Emily recognizes that each of her children has unique learning styles and needs, so she values tools that can adapt and provide personalized experiences.
- Transitioning from Play to Learning:** Emily faces the challenge of seamlessly transitioning her children from playtime to focused learning activities, and she seeks tools that can make this transition engaging and enjoyable for her kids.

Goals

- Convenience:** Emily's busy work schedule makes it important for her to find efficient and convenient ways to support her children's learning outside of school.
- Engaging Activities:** She values activities that are not only educational but also enjoyable and interactive for her kids.
- Quality Education:** Emily believes in the importance of a strong educational foundation for her children and actively seeks out tools and resources to enhance their learning.
- Technology Integration:** As someone working in the tech industry, Emily is comfortable with technology and appreciates its potential to enhance her children's learning experiences.

Personality



Extrovert

Feeling

Intuition

Perceiving

Dr Olivia Bennett

Age: 50
Work: Researcher
Family: Single
Location: San Jose, CA
Character: The Computer Nerd



"Empowering Education through Innovation: Nurturing Minds with Data-Driven Learning Solutions."

Friendly Clever Go-Getter

Goals

- Educational Excellence:** Dr. Bennett is deeply committed to advancing the field of education and ensuring that all children have access to high-quality learning experiences.
- Evidence-Based Practices:** She believes in the importance of using research and data to inform educational strategies and create effective learning environments.
- Holistic Learning:** Dr. Bennett values a holistic approach to education, emphasizing not only academic skills but also social, emotional, and cognitive development.

Bio

Dr. Olivia Bennett is a 50-year-old educational psychologist and researcher with a distinguished career in child development. She holds a Ph.D. in Educational Psychology and has published numerous articles and books on effective teaching methods for young learners. Dr. Bennett is a professor at a renowned university and is dedicated to shaping the future of education through research and innovative practices.

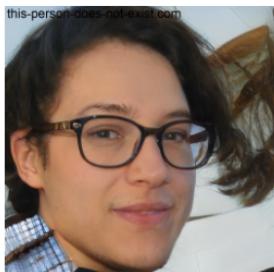
Needs and Challenges

- Cutting-Edge Tools:** Dr. Bennett is always on the lookout for innovative tools and technologies that can enhance teaching and learning, aligning with her research-oriented mindset.
- Effective Learning Solutions:** She seeks resources that can address the diverse needs of students and provide differentiated instruction to support optimal learning outcomes.
- Data-Driven Insights:** Dr. Bennett needs tools that offer detailed data and insights into students' progress, helping her refine her teaching methods and interventions.

Personality



Dr. Alan Roberts



Age: 38
Work: Researcher In AI
Family: 3 roommates
Location: Detroit, MI

"Elevating Education with AI: Where Innovation and Learning Converge for a Brighter Future."

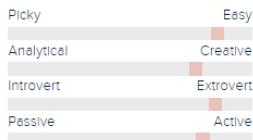
Goals

- Advancing AI Education:** Dr. Roberts is passionate about pushing the boundaries of AI to enhance educational experiences and create new opportunities for learning.
- Research Excellence:** He is dedicated to conducting rigorous and impactful research that contributes to the advancement of AI and its applications in various domains.
- Interdisciplinary Collaboration:** Dr. Roberts values collaboration with experts from diverse fields, believing that combining AI with other disciplines can lead to transformative breakthroughs.
- Ethical Innovation:** He is committed to developing AI technologies that are ethically responsible and have a positive impact on society.

Bio

Dr. Alan Roberts is a 38-year-old computer scientist and AI researcher. He holds a Ph.D. in Artificial Intelligence from a prestigious university and has a strong track record of groundbreaking research in machine learning and robotics. Dr. Roberts is known for his innovative thinking and his contributions to the development of cutting-edge AI technologies.

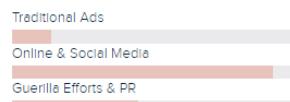
Personality



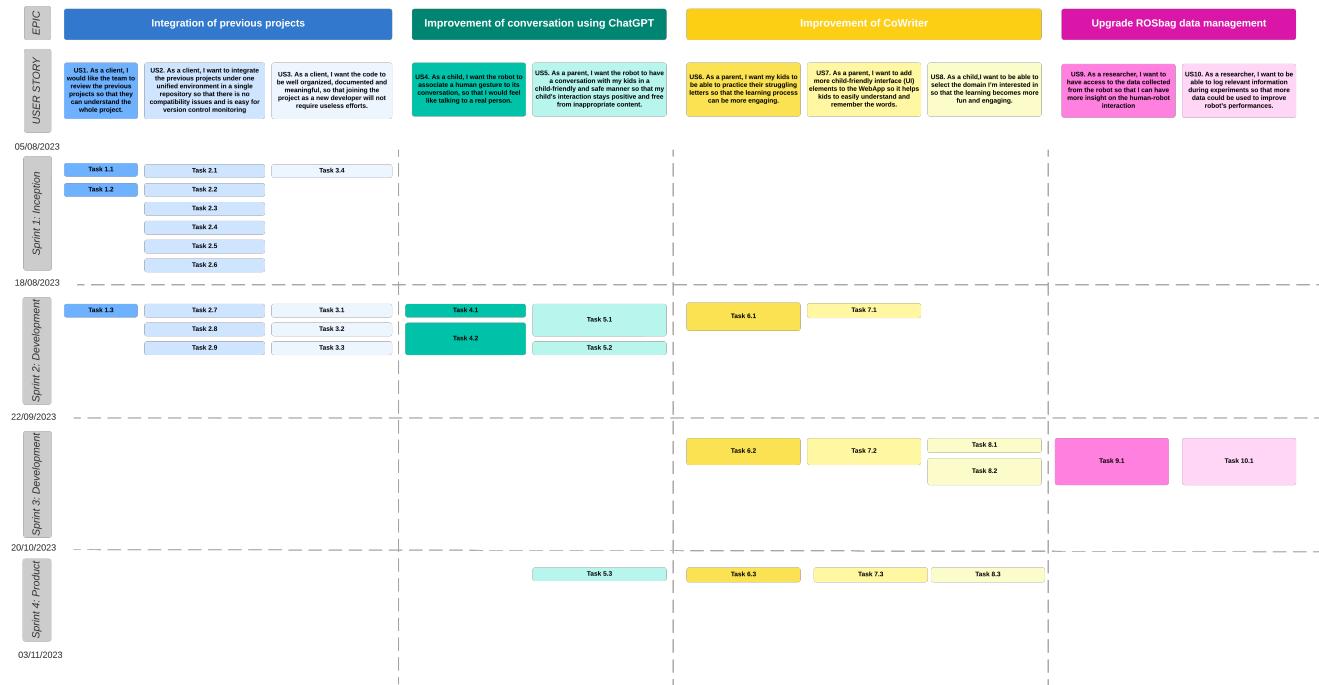
Frustrations

- Real-World Application:** He is interested in AI projects that have practical applications and can address real-world challenges, particularly in the field of education.
- Adaptive Learning:** He is intrigued by the potential of AI to provide personalized and adaptive learning experiences, catering to individual student needs and learning styles.
- Data-Driven Insights:** Dr. Roberts requires access to detailed data and analytics to analyze the effectiveness of AI-driven educational tools and refine their algorithms.

Preferred Channels



Sprint Planning



1. Task with larger square box means it has more points.
2. We still have problems with some user stories, so some of them won't have too much. We will update it after the next meeting with client.

Trello : <https://trello.com/invite/b/CPdSWap5/ATTIdcb481b112c05c9eb2833be7521b972a4EC07C65/comp90082-2023-sm2-na-redback>

Sprint1:Inception Planning

Sprint 1 Goal

For Sprint 1, our primary objective is to lay a solid foundation for the upcoming project by initiating productive interactions with our clients and comprehensively understanding their requirements. This involves engaging in an initial meeting with our clients to establish a clear scope and user stories for the project. The user stories and tasks should be arranged and distributed into sprints. In addition, we will delve into the past projects executed by our fellow teams to gain valuable insights and enhance our understanding of best practices.

Key Milestone

1. **Client Interaction:** Arrange and conduct an initial meeting with the clients. During this session, our aim is to establish rapport, communicate our team's expertise, and create an environment conducive to open dialogue. This interaction will also serve as an opportunity to gather preliminary information regarding the project's objectives, desired outcomes, and any specific requirements or constraints.
2. **Requirements Identification:** Thoroughly document all the insights obtained from the client interaction. Extract and clarify the project's core requirements, functionalities, and potential challenges. Ensure that all stakeholders are on the same page regarding the project's scope and expectations.
3. **Project History Review:** Examine the previous projects undertaken by other teams within the organization. This review will provide valuable context, highlighting successful strategies, potential pitfalls, and opportunities for innovation. By understanding the evolution of similar projects, we can leverage lessons learned and align our approach accordingly.
4. **Resource Preparation:** Compile and organize the necessary resources for the project. This includes refining our understanding of the technologies, tools, and methodologies that will be employed. By familiarizing ourselves with the project's technical landscape, we can streamline our execution and minimize potential roadblocks.

Expected Outcomes

By the end of Sprint 1, we aim to have a comprehensive understanding of the project's requirements, a clear overview of the client's expectations, and insights from previous projects that will guide our decision-making. This holistic preparation will set the stage for successful project execution in the upcoming sprints, ensuring that our team is well-equipped to deliver a solution that aligns with the client's needs and industry best practices.

- Background description
- DO-BE-FEEL list
- GOAL MODEL
- Personas
- User Stories
- Trello
- Development Environment
- Setting Github
- Plan diagram

Trello : <https://trello.com/invite/b/CPdSWap5/ATTIdcb481b112c05c9eb2833be7521b972a4EC07C65/comp90082-2023-sm2-na-redback>

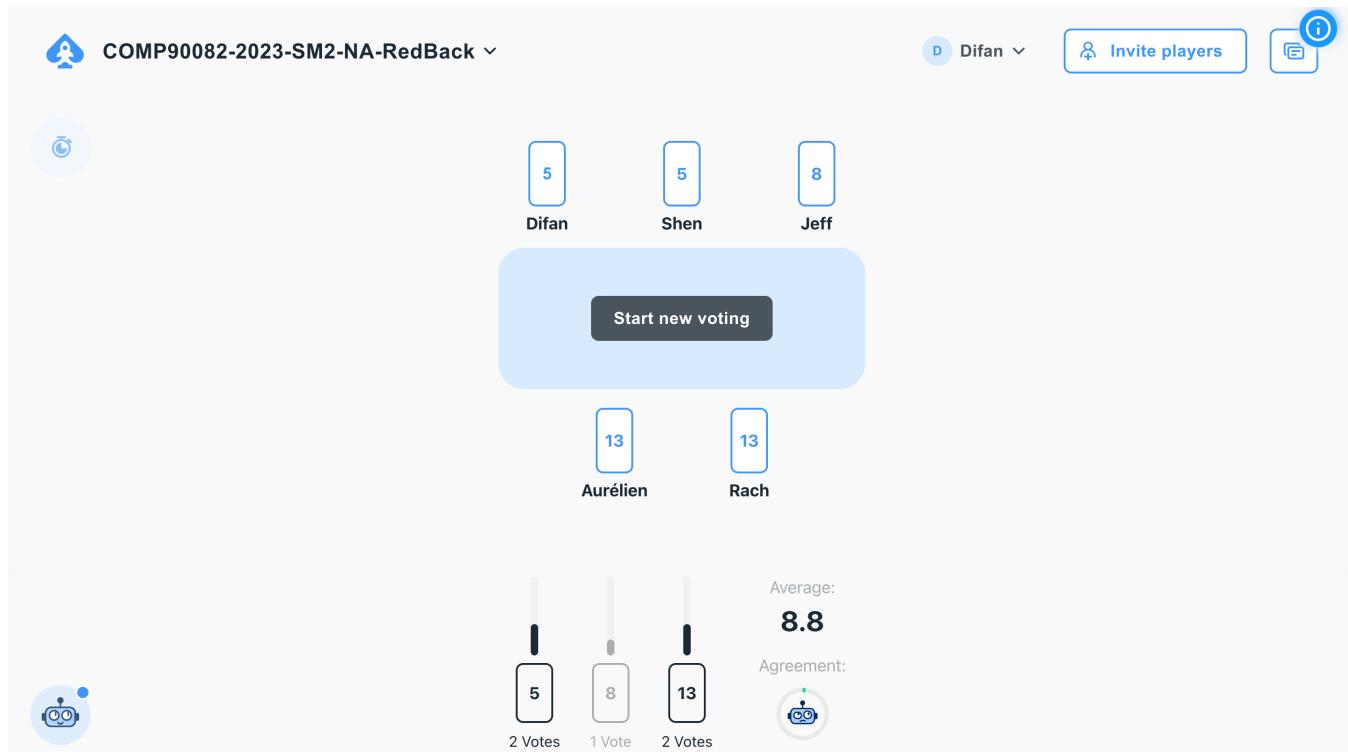
ChatGPT Generated: Yes

Sprint Retrospective

(Waiting for update)

Appendix

Appendix A - Planning Poker



Appendix B - Trello

