CS 25-332 AI tool for automated scanning and understanding of new scientific or technical posts and alerting about new information relevant to users interests

Preliminary Report

Prepared for

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Executive Summary

Our senior design team is developing an AI-powered recommendation system for the educational website arxiv.org that offers personalized content suggestions beyond search and browsing methods. The project aims to create an AI-recommendation system that understands users' interests based on their interaction with other posts and brings relevant school articles and reports based on their preferences. The design requirements include building a scalable and user-friendly system capable of processing large data. Key constraints include data privacy, AI accuracy optimization, and meeting development deadlines. The final project will consist of a prototype of a fully functional AI recommendation system integrated into the Arxiv website and a user interface personalized for user content. The project's key deliverables include gathering system requirements, preprocessing data, and initiating the development of an AI recommendation system. The project is set to significantly improve user experience with the website and enhance and simplify content discovery.

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Section A. Problem Statement

1. Introduction

In a world with over 2.5 million research articles published annually [1] (and growing!), the ability to access, comprehend, and utilize the accumulated information has become increasingly challenging. Alarmingly, it takes an average of 17 years for critical research findings to influence clinical practice and policy decisions [2]. Indicating currently millions of healthcare providers, governance, and every field across all varieties are relying on outdated information. This disconnect not just hampers advancements in healthcare, technology, and policy reform, but also the advancement of common knowledge more generally.

2. The Widespread Challenge

2.1 Healthcare Providers

Imagine a doctor making life-altering decisions based on outdated protocols, simply because they lack access to the latest research. In the U.S. alone, it's estimated that >200,000 deaths occur each year due to preventable medical errors [3].

2.2 Engineers and Innovators

Specifically, engineers across all disciplines, from civil to biomedical, face similar hurdles. They need access to the latest advancements in their fields to update, upgrade, and solve pressing issues like urban infrastructure, public health technology, and waste management just to name small examples. For instance, new materials in structural engineering can significantly improve the safety of buildings in earthquake-prone areas, and the delay in disseminating this knowledge could cost lives and resources.

2.3 Policymakers and Community Leaders

Policymakers depend on accurate scientific evidence to make informed decisions that affect public welfare. However, the complexity of navigating scientific literature can delay crucial legislative actions, resulting in missed opportunities for societal advancement. Delays in policy

decisions due to insufficient data can extend for years, causing valuable legislation to be overlooked entirely.

3. The Role of AI-Based Personalized Science

Existing platforms in the engineering space fail to deliver relevant updates effectively. While some resources provide access to research papers, they often do so in a fragmented manner that lacks coherence and contextual relevance. Engineers spend excessive time sifting through irrelevant data, detracting from their ability to innovate and implement solutions.

To bridge this critical gap, we propose an AI-driven personalized science platform designed to tailor content delivery according to individual interests, expertise, and needs. This revolutionary approach aims to:

3.1 Real-Time Updates

Healthcare professionals will receive instant notifications about relevant advancements, transforming how they make treatment decisions and ultimately improving patient outcomes.

3.2 Interdisciplinary Insights

By uncovering connections across diverse fields, our platform will foster collaboration that leads to groundbreaking innovations. For example, merging insights from materials science and public health can yield new strategies to combat infectious diseases.

3.3 Enhanced Accessibility

Complex scientific concepts will be distilled into digestible formats, making it easier for everyone—from curious laypeople to seasoned professionals—to engage with critical findings.

4. Historical Perspective and Existing Solutions

Historically, the transfer of scientific knowledge has been fraught with inefficiencies. While tools like academic search engines and reference management software exist, they often fail to deliver timely, relevant information in a usable format.

4.1 Limitations of Current Solutions

Existing systems, such as Google Scholar and PubMed, provide broad coverage but lack the capacity to package information effectively. They generate overwhelming results without context, forcing users to sift through mountains of data to find what is truly relevant. This fragmented approach results in slow workflows that discourage discovery and innovation.

Competitors in the Space:

1. PubMed - Comprehensive medical literature but not effectively packaged for quick insights.
2. Google Scholar - Overwhelming results with little filtering for practical relevance.
3. ResearchGate - Networking for researchers; lacks streamlined content delivery and relevance.
4. Mendeley - Useful for organization but fails to offer meaningful recommendations.
5. Scopus - Broad database; not designed for personalized, quick content delivery.

5. Human Impact and Community Benefits

The key groups benefiting from this platform include:

1. Healthcare Providers: Who need timely updates to offer the best possible care.
2. Engineers and Innovators: Committed to solving everyday challenges through improved access to scientific advancements.
3. Policymakers and Community Leaders: Striving for informed decisions that benefit society at large and small.

5.1 Economic Growth and Innovation

By streamlining research funding and increasing the efficiency of knowledge application, our platform could lead to substantial economic benefits. Enabling researchers and professionals to focus on meaningful inquiries rather than sifting through irrelevant data could enhance innovation across all sectors.

5.2 Fostering a Science-Literate Society

This platform will cater not just to professionals but also to the general public, promoting science literacy and empowering individuals to make informed decisions about health, technology, and policy.

6. Conclusion

The proposed AI-based personalized science dissemination platform represents a transformative approach to how we share and utilize scientific knowledge. By bridging the gap between discovery and practical application, we can enhance lives, spark innovation, and foster a society that values and understands science. Addressing challenges related to data quality, privacy, and algorithmic transparency will be essential to realizing this vision.

As we move forward, let's prioritize the needs of people and communities, ensuring that science becomes an accessible resource for all. Together, we can create a future where knowledge flows freely, innovation thrives, and society is better equipped to tackle the challenges ahead.

References

1. Benjamin Schneider, J. A. (n.d.). *Science & Engineering Indicators*. NSF. https://ncses.nsf.gov/pubs/nsb202333/publication-output-by-region-country-or-economy-and-by-scientific-field
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3. Narrowing the 17-year research to Practice Gap | American Journal of Critical Care | American Association of Critical-Care Nurses. (n.d.). https://aacnjournals.org/ajcconline/article/25/3/194/3121/Narrowing-the-17-Year-Research-to-Practice-Gap

Section B. Engineering Design Requirements

B.1 Project Goals (i.e. Client Needs)

The goal of this project is to provide users with an automated tool that scans, interprets, and alerts them about new scientific or technical content relevant to their specific areas of interest. By focusing on the client's needs, this AI tool aims to simplify the process of staying updated with the latest advancements without manual searching or filtering.

Key goals:

1. To automate the process of scanning new scientific and technical content.
2. To ensure that users receive timely and relevant updates on topics of interest.
3. To reduce the time and effort required by users to stay informed.
4. To enhance the accuracy and relevance of information delivered to users.
5. To create a scalable system adaptable to various industries and areas of interest.

B.2 Design Objectives

- The design will automatically scan and categorize newly published scientific literature from at least 5 major open-access journals in the user's specified field within 48 hours of publication, achieving 80% accuracy as verified by subject matter experts, by the end of the first semester.
- The design will deliver personalized content recommendations with a relevance accuracy of at least 70%, as rated by a test group of 18 users, by the end of the project period.
- The design will organize and deliver content in thematic packets for at least 3 major scientific disciplines, reducing the time users spend finding related information by 40% compared to traditional search methods, as measured by user surveys by the end of the second semester.
- The design will achieve a user satisfaction rate of 75% for its content curation features, as measured by feedback from a test group of 18 users, by the end of the project period.
- The design will implement a simple relevance ranking system that improves the precision of content delivery by 40% compared to basic keyword searches, as measured by user feedback from the test group, by the end of the second semester.

- (optional) The design will provide context-rich summaries for 60% of delivered content, improving user comprehension by 20% compared to reading raw scientific papers, as measured by comprehension tests with a sample group of 30 users by the end of the project.
- (optional) The design will implement a basic conflict of interest analysis for 70% of delivered content from the selected journals, as verified by random sampling, by the end of the second semester.

B.3 Design Specifications and Constraints

Design Specification:

- The design must be highly accurate in recommending different posts to users. Accuracy should reach at least 85%
- AI must be compatible with the interactions users have with the archive website. Interactions include the posts they open, if they accessed the articles, what they searched for, the history with other posts, and authors
- The AI should be able to process the archive API LLM, and be able to process the interactions of users
- AI must have a fast response time and bring similar posts one second after user's interaction
- AI must follow data privacy and data protection regulations

Realistic Constraints:

- Design must be worked for 1000 hours without needing maintenance
- Design must operate with archive website and API
- Design must be started from scratch with coding from this group
- Cost of training can't be over $1000
- Scanning should only ascertain relevance from the abstracts, not the full document
- Cost should be partially funded by users. Either by token or a freemium plan.
- Design must run on cloud services and process with high data storage
- Design must be able to work with any devices such as smartphones, laptops, or any other browser device

B.4 Codes and Standards

- Design must protect all data provided from users.
- Design must follow all the specifications provided by the company/sponsor.
- All aspects in the design process and design plan must be well documented.
- Code must have comments providing explanations on its purpose.
- All documentation must be stored in the project repository located on github.
- Every task must be completed by the designated date it is required by.
- All members of the design team must have weekly meetings with the sponsor and with the team to share progress on the design.
- Design must run in a reasonable time without an excessive wait time.
- Design main components must be from Arxiv, Arxiv's API, and the chosen LLC.

Section C. Scope of Work

C.1 Deliverables

Deliverables:

- Team contract
- Project proposal
- Fall poster and presentation
- Preliminary design report
- Final design report
- Working AI tool prototype
- AI tool prototype code
- Finalized and functioning AI tool code
- Capstone EXPO poster and presentation

Potential Obstacles:

- The fall poster and Capstone EXPO poster require the team to meet in person to work on it, so there could be potential scheduling conflicts.
- All the aspects of the project that require purchasing have to fit within the budget of $1,000.
- API not following prompt instructions how intended even after many iterations.

C.2 Milestones

Milestones	Description	Time Estimated	Completion Data
Gathering required resources and archive data	Gathering the required resources to get started on project and getting data from archive website	2 weeks	October 12th
Pre-process and evaluate trained data	Data we are getting is already trained, so we pre-process the trained data and confirm its correct	3 weeks	November 2nd
UI/UX Design (Kyle)	Develop user interface for website	2 weeks	November 16th
Integration to website and testing	Integrate AI into website and test and debug AI as needed	3 weeks	December 7th

C.3 Resources

The following resources will be required for the successful completion of the AI tool project. These resources will either be covered within the project budget or provided by the project sponsor. The list includes hardware, software, and other services critical to the design, development, and implementation of the AI system.

- **Hardware**: Access to high-performance computing (HPC) systems or cloud-based servers for running machine learning models and processing large datasets efficiently.
- **Software**: Integrated development environments (IDEs) such as PyCharm or VSCode for writing and testing code, as well as machine learning frameworks like TensorFlow or PyTorch.
- **Cloud Computing**: Use of cloud platforms such as AWS or Google Cloud to scale machine learning processes and manage large-scale data analysis tasks.
- **Data**: Databases containing relevant scientific and technical posts for training and testing the AI tool, as well as publicly available datasets for model validation.
- **Libraries & APIs**: Machine learning libraries such as Scikit-learn, Natural Language Processing (NLP) libraries like SpaCy, and APIs for web scraping and gathering new content for the system.
- **Version Control**: A version control system such as GitHub to manage and track changes in code development.

Section D. Concept Generation

Core Features Concepts

1. Automated Scanning and Understanding:
    - AI scans and (surface level) understands new scientific and technical literature, going beyond simple keyword matching.

2. Personalized Content Delivery:
    - Users initialize their profile by specifying their primary and secondary fields of expertise and interests.
    - Interests metrics combined into a single document, allowing the AI to tailor content recommendations based on user preferences.

3. Dynamic Relevance Ranking:
    - Content is ranked and categorized based on user-defined interests, ensuring highly relevant information is highlighted.

4. Contextual Package Delivery:
    - Articles and papers are delivered in structured packets, grouped by themes and relevance, rather than as a sparse vertical list.
    - Rough examples: (!) Major update, (!!) Breakthrough, (#) Reaffirmation and overview (X) Retraction (?) Exploratory / preliminary (??) Conflict (@) Protocol / methodology
    - Organized for daily narrative interest

5. Engagement scheduling insight
    - Scheduling to release for engagement and interest
    - Dynamic sending of more relevant vs more exploratory information based on where someone is in their research process

6. Curation scheduling daemon
    - Schedule to produce look through sections for given person

7. Utility Functions:
    - Under each category, there will be an appearing button to produce more results of the type kind.
    - Show more, remove, remove with prejudice, add category

Potential Features concepts

1. Additional Generated Context (possibly optional):
    - AI Category Commentary and Summary: A separate quick, cheaper AI provides contextual commentary on various categories of content, summarizing key points and trends within those categories.
    - Science Hole Identifier: Attempts to pull, if insufficient, mentions gaps in research and highlights areas lacking sufficient studies, providing context on why those gaps exist.
    - Conflict of Interest Analysis: Evaluates funding sources and potential biases to provide transparency on the research presented.
    - Conclusion RE: Checks the disparity between the conclusion and the article. if its wide (overstating, misrepresenting data, understating), then it'll rewrite a new conclusion and make a statement
    - Overtalking ratio: Scans for the relevant pieces of information, their weight, their method, and optionally reduces it to minimized form if it includes too little information compared to volume.
    - Speech style rewrite: Just a simple converter on the style of language while still retaining all of the information. Ex. Straightforward and reduced, curious, bitter, sweet, encouraging, rude, narrative, If I were 12, etc.
    - Package Completion meter: Of a given article packet, a circle indicator for how complete it is

2. Maintained meta commentary
    - Meta Review / Book of Articles Maintainer Functionality: Automatically generates a consensus or contention report summarizing key findings across related articles.
        - Creates and maintains books as a series of 50 or so article which are sort of the core findings of an entire field
    - Lab and scientist tracker: Identified and grouped specialists

4. Educational Narrative Series:
    - A dedicated packaged section for teaching users foundational knowledge in their areas of interest.

Scheduling components

Input layer ()

a. Series of questions, piped into a single paragraph.
    i. Help me write this!
    ii. general field?
b. A single paragraph written by them, then summarized and extrapolated by quick summary ai.

Rank and file layer ()

a. Prejudiced selection. Sort and rank relevance by title and summaries
b. The two stage review. First with title abstract relevance en masse, then a deep review of the quality and deeper relevance.

Growth layer ()

a. Simple growth. Consume all newly released.
b. Constrained growth. Consume a constrained category
c. Backlog discovery. Consume all old

Retrieval layer ()

a. Simple relevance query set of 12
b. Multiple category query. Sends many different retrieval request based on category,
    i. Packets being made of the generated categories of interest, then populated.

Display layer ()

1. Sorted and categorized in post
2. User interface being an embedding of links.
3. Chatgpt / claude style interface?

Section E. Concept Evaluation and Selection

	Automated Scanning and Understanding	Personalized Content Delivery	Contextual Package Delivery	Dynamic Relevance Ranking	Utility functions
Importance	10	10	8	10	7
Feasibility and unknowns	7	6	9	6	9
Time to complete	2	3	4	3	4
Security	10	7	7	8	6
User Experience	10	10	9	10	7
Total score	37	36	31	27	33

Discussion:

The ranking categories are all based on two factors, how we're going to do them and if they'd be good features for the given user. Importance is just its overall intrinsic weight toward the power of the project, feasibility is our ability to complete it, time is time, security, and user experience are rest self descriptory.

Section F. Design Methodology

Iterative engineering design process

LLM options: GPT4, Claude Opus, Gemini, and Llama3

Ryan: Gemini

Alex: Llama3

Kyle: GPT4

Katie Claude Opus

F.1 Experimental Methods

1. Implement the Arxiv API to gain access to the abstracts of the papers so it can be inputted to the different LLM's.
2. Research and gather suitable LLM's that can compare abstracts to user's interests and recommend papers based on the abstract's similarity to the user's interest.
3. Create multiple test case users with interests and input multiple abstracts to the different LLM's for it to provide an output on how much it matches the user's interests.
4. Compare the outputs and decide which LLM has the best outputs that align with the interests.

F.2 Validation Procedure

To validate that the final design meets the client's needs, the team will schedule a demonstration meeting in early April. During this session, the prototype will be showcased, highlighting features such as dynamic dialogue, tailored search refinement, and the overall user interface. The team will capture client feedback through a formal survey evaluating usability and effectiveness, complemented by a brief interview for qualitative insights. Additionally, observation notes will be taken as the client interacts with the prototype to identify any usability issues. Feedback from potential end-users will also be gathered through pilot testing, ensuring the design meets broader user expectations and aligns with the client's goals.

Section G. Results and Design Details

G.1 Experimental and Testing Results

For our initial prototype we decided to just use Gemini because it is the easiest to implement and it is free to use. The prompt given while testing instructed the API to return the top matching articles that were released recently and to give them a rating based on how similar they are to the set of interests provided. Through our testing we found that using a more specific set of user interests made it more likely for the top matches to be rated highly and the rest to be sub par. Providing a vague set of interests would make it so that a lot of the abstracts returned would have a very average rating of similarity. I believe that this is because finding articles about a very general topic is very difficult since scientific articles are typically focused on one subject matter. During the testing process we reviewed the abstracts that were being returned as most similar and analyzed them to see if they matched. There were some cases where an abstract would be recommended as more similar to the set of interests when there was another abstract that we thought would be better suited. However, in most cases the order articles that were being returned was usually accurate to how similar they were to the set of interests.

G.2. Final Design Details/Specifications

For our final design we would like to improve our prompt so that the API is able to return articles that match better based on our analysis. A possible detail added to our design is a feedback system which would assist the API in finding articles best suited for each user. Users can choose to provide feedback on whether an article suited their interests or not. Based on their response, the API can take that into consideration for future analysis of articles. This will make it so that even if the prompt does not start out with the most accurate results, over time the API will build a set of interests tailored to each user so that it can look for what it knows each user will want. We also are going to implement the API so that it is able to consistently check Arxiv when new articles are updated. Along with that, we will make it so that the program is able to send alerts when a new article has been posted that has a high enough similarity to the user’s interests. The API being used will be decided after further research and testing between them all to see which one will work best for our design and functionality. The final implementation will most likely be held on a website that is either locally hosted or through the cloud, and will provide the basic functions of our AI tool.

Section H. Societal Impacts of Design

H.1 Public Health, Safety, and Welfare

Our AI tool has the potential to improve public health and safety by accelerating the adoption of the latest research findings in critical areas like medicine and engineering. By delivering timely, relevant updates, healthcare providers can make better-informed decisions, reducing preventable errors. Additionally, engineers can use these insights to design safer structures and systems. To ensure user safety, the tool is designed with data privacy and security features that comply with regulations like GDPR, protecting sensitive user information.

H.2 Societal Impacts

This tool promotes a more informed and innovative society by bridging the gap between vast scientific resources and their practical application. The personalized recommendation system ensures that users receive content tailored to their interests, enabling faster adoption of new ideas and fostering interdisciplinary collaboration. By making complex research accessible and relevant, the tool empowers users to address pressing challenges like sustainability, public health, and technological innovation.

H.3 Political/Regulatory Impacts

Policymakers and regulatory bodies can benefit greatly from the tool's ability to provide concise and relevant summaries of recent research. Quick access to reliable data can accelerate informed decision-making and improve the effectiveness of policies. Furthermore, the tool's transparent operation ensures trust in its recommendations, which is essential in environments where misinformation or biased data can undermine confidence in technology.

H.4. Economic Impacts

By automating the discovery and analysis of scientific articles, the tool reduces the time professionals spend searching for relevant information. This efficiency can enhance productivity in fields like research, engineering, and healthcare, driving economic growth. Additionally, the tool's planned freemium model ensures affordability, making its benefits accessible to individuals and organizations with limited budgets.

H.5 Environmental Impacts

The tool indirectly contributes to environmental sustainability by expediting access to research on eco-friendly technologies, renewable energy, and conservation methods. For instance, engineers and researchers can quickly adopt innovations in green building materials or sustainable practices, reducing the environmental footprint of projects and operations.

H.6 Global Impacts

By providing universal access to scientific advancements, the tool helps bridge gaps in global knowledge sharing. Researchers and professionals in under-resourced regions can access the same high-quality, curated information as their peers elsewhere, fostering global collaboration and equity. Its cloud-based design ensures scalability and reliability for users worldwide, creating a truly global impact.

H.7. Ethical Considerations

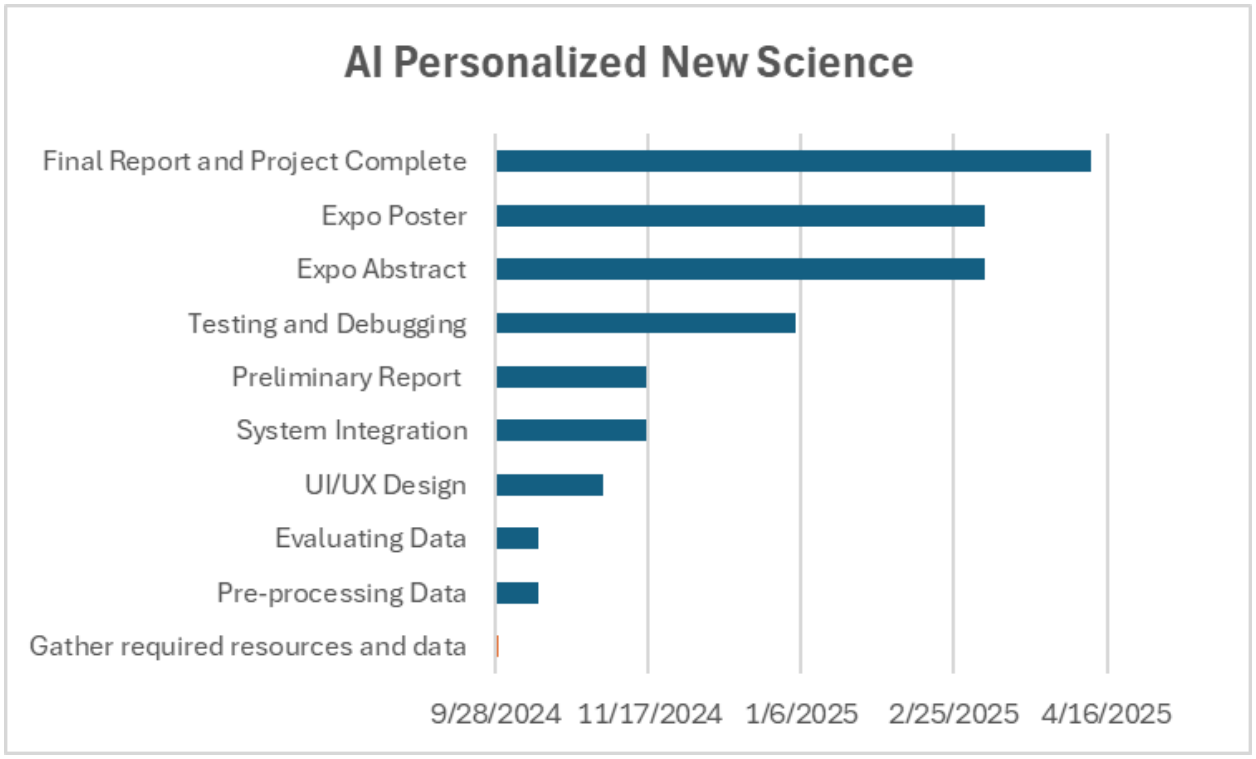
Ethical considerations are central to the design of this tool. Transparency in recommendations, respect for user privacy, and safeguards against misuse are foundational principles. The tool's ability to democratize access to knowledge addresses ethical concerns around inequities in information availability. Additionally, it aims to avoid bias in recommendations and ensures that pseudoscientific or misleading content is minimized, fostering trust and reliability.

Section J. Conclusions and Recommendations

The primary goal of our AI project is to enhance article recommendations for users by analyzing their queries, outperforming traditional history- and search-based engines. To achieve this, we adopted an iterative engineering design process. Initially, we focused on integrating an API with the Arxiv website for the back-end functionality. Once the back-end connection was established, our attention shifted to creating and linking the front-end interface. This integration allows users to interact with a website powered by AI, marking a significant step toward meeting our project objectives.

Throughout development, we encountered challenges such as ensuring seamless connections between our code and online APIs and aligning the front-end and back-end components. Despite these hurdles, we succeeded in developing a unique feature: Gemini's dynamic dialogue, which displays articles and refines searches based on user input. For future advancements, we aim to add images to search results, establish a cloud-based database, and improve AI accuracy through a confusion matrix and additional testing. With foundational milestones completed, such as API integration and front-end/back-end connectivity, future efforts can focus on refining performance, tackling large language model limitations, and enhancing usability features for broader adoption.

Appendix 1: Project Timeline



Appendix 2: Team Contract (i.e. Team Organization)

Step 1: Get to Know One Another. Gather Basic Information.

Task: This initial time together is important to form a strong team dynamic and get to know each other more as people outside of class time. Consider ways to develop positive working relationships with others, while remaining open and personal. Learn each other's strengths and discuss good/bad team experiences. This is also a good opportunity to start to better understand each other's communication and working styles.

Team Member Name	**Strengths each member bring to the group**	**Other Info**	**Contact Info**
Kyle Vinod	Communicates well with everyone, plans out meeting and communicates with advisor, deterministic	1 year internship experience, knowledgeable with Python, C, C++, Java, SQL, JavaScript, and Linux, knowledge of NLP and machine learning	vinodkn@vcu.edu
Katie Martinez	Communication, problem-solving, and adaptability	Experience in Java and C.	martinezk4@vcu.edu
Ryan Ta	Clear communication, willing to learn new things, wide availability	I have experience in C and Java. I will put the work in to learn anything new assigned to me.	tard@vcu.edu
Alexander Larios	Fast comprehension, clear communication, wide and strong curiosity, and creative generativity.	Experienced in C, Java, and Python. Good grip on the overarching fundamentals to the project.	Lariosas@vcu.edu

Other Stakeholders	Notes	Contact Info
Tom Arodz	Faculty advisor and sponsor	tarodz@vcu.edu

Step 2: Team Culture. Clarify the Group's Purpose and Culture Goals.

Task: Discuss how each team member wants to be treated to encourage them to make valuable contributions to the group and how each team member would like to feel recognized for their efforts. Discuss how the team will foster an environment where each team member feels they are accountable for their actions and the way they contribute to the project. These are your Culture Goals (left column). How do the students demonstrate these culture goals? These are your Actions (middle column). Finally, how do students deviate from the team's culture goals? What are ways that other team members can notice when that culture goal is no longer being honored in team dynamics? These are your Warning Signs (right column).

Culture Goals	Actions	Warning Signs
Communicating well within the group	- Texting within Capstone group chat - Communicating any problems help is needed with	- No text back in group chat in few days - Student struggles with a part of the project with deadline coming up
Respectful communication	- Encourage open discussions - Use constructive feedback	- Talking over others - Dismissive tone
Accountability	- Share regular progress updates - Set clear deadlines	- Missed tasks - Avoiding progress discussions

Step 3: Time Commitments, Meeting Structure, and Communication

Task: Discuss the anticipated time commitments for the group project. Consider the following questions (don't answer these questions in the box below):

- What are reasonable time commitments for everyone to invest in this project?
- What other activities and commitments do group members have in their lives?
- How will we communicate with each other?
- When will we meet as a team? Where will we meet? How Often?
- Who will run the meetings? Will there be an assigned team leader or scribe? Does that position rotate or will the same person take on that role for the duration of the project?

Required: How often you will meet with your faculty advisor advisor, where you will meet, and how the meetings will be conducted. Who arranges these meetings?
See examples below.

Meeting Participants	**Frequency Dates and Times / Locations**	**Meeting Goals Responsible Party**
Students Only	As needed, we text within the group chat	Update group on day-to-day challenges and accomplishments
Students Only	Every Thursday at 3 pm, we meet on Zoom	Actively work on project, discuss any problems, update group, and discuss new tasks
Students + Faculty advisor	Every Tuesday at 10:30 am in Advisor's Zoom meeting	Update faculty advisor and get answers to our questions
Project Sponsor	Every Tuesday at 10:30 am in Sponsor's Zoom meeting	Update project sponsor and make sure we are on the right track

Step 4: Determine Individual Roles and Responsibilities

Task: As part of the Capstone Team experience, each member will take on a leadership role, ***in addition to*** contributing to the overall weekly action items for the project. Some common leadership roles for Capstone projects are listed below. Other roles may be assigned with approval of your faculty advisor as deemed fit for the project. For the entirety of the project, you should communicate progress to your advisor specifically with regard to your role.

- **Before meeting with your team**, take some time to ask yourself: what is my "natural" role in this group (strengths)? How can I use this experience to help me grow and develop more?
- **As a group**, discuss the various tasks needed for the project and role preferences. Then assign roles in the table on the next page. Try to create a team dynamic that is fair and equitable, while promoting the strengths of each member.

Communication Leaders

Suggested: Assign a team member to be the primary contact for the client/sponsor. This person will schedule meetings, send updates, and ensure deliverables are met.

Suggested: Assign a team member to be the primary contact for faculty advisor. This person will schedule meetings, send updates, and ensure deliverables are met.

Common Leadership Roles for Capstone

1. **Project Manager**: Manages all tasks; develops overall schedule for project; writes agendas and runs meetings; reviews and monitors individual action items; creates an environment where team members are respected, take risks and feel safe expressing their ideas.
   Required: On Edusourced, under the Team tab, make sure that this student is assigned the Project Manager role. This is required so that Capstone program staff can easily identify a single contact person, especially for items like Purchasing and Receiving project supplies.
2. **Logistics Manager**: coordinates all internal and external interactions; lead in establishing contact within and outside of organization, following up on communication of commitments, obtaining information for the team; documents meeting minutes; manages facility and resource usage.
3. **Financial Manager**: researches/benchmarks technical purchases and acquisitions; conducts pricing analysis and budget justifications on proposed purchases; carries out team purchase requests; monitors team budget.
4. **Systems Engineer**: analyzes Client initial design specification and leads establishment of product specifications; monitors, coordinates and manages integration of sub-systems in the prototype; develops and recommends system architecture and manages product interfaces.
5. **Test Engineer**: oversees experimental design, test plan, procedures and data analysis; acquires data acquisition equipment and any necessary software; establishes test protocols and schedules; oversees statistical analysis of results; leads presentation of experimental finding and resulting recommendations.
6. **Manufacturing Engineer**: coordinates all fabrication required to meet final prototype requirements; oversees that all engineering drawings meet the requirements of machine shop or vendor; reviews designs to ensure design for manufacturing; determines realistic timing for fabrication and quality; develops schedule for all manufacturing.

Team Member	Role(s)	Responsibilities
Kyle Vinod	Project manager and Logistics manager	- Help with assigning different tasks and help with each as needed - Schedule meetings with team members, advisor, and sponsor - Team members are comfortable and able to present their ideas

Ryan Ta	Financial manager and Systems Engineer	- Planning out purchases that need to be made and analyzing how it will fit into our budget. - Working with client requests to ensure that their specifications are incorporated into the final product.
Katie Martinez	Manufacturing Engineer	- Managing deadlines with suppliers/vendors. - Ensuring designs meet manufacturability and quality standards. - Continuous process improvement and troubleshooting. - Strong focus on practical, hands-on production knowledge and process efficiency.
Alexander Larios	Test engineer	- Developing and managing experimental design. - Testing, producing, and overseeing analysis. - Leading presentation of experimental finding and recommendations.

Step 5: Agree to the above team contract

Team Member: Kyle Vinod Signature: *Kyle Vinod*

Team Member: Ryan Ta Signature: *Ryan Ta*

Team Member: Katie Martinez Signature: *Katie Matrinez*

Team Member: Alexander Larios Signature: *Alexander*

References

Provide a numbered list of all references in order of appearance using APA citation format. The reference page should begin on a new page as shown here.

[1] VCU Writing Center. (2021, September 8). *APA Citation: A guide to formatting in APA style.* Retrieved September 2, 2024. https://writing.vcu.edu/student-resources/apa-citations/
[2] Teach Engineering. *Engineering Design Process*. TeachEngineering.org. Retrieved September 2, 2024. https://www.teachengineering.org/populartopics/designprocess