

Problem Statement and Goals

ProgName

Team #, Team Name
Student 1 name
Student 2 name
Student 3 name
Student 4 name

Table 1: Revision History

Date	Developer(s)	Change
09/23/2025	All	Add first draft of problem statement and goals
Date2	Name(s)	Description of changes
...

1 Problem Statement

1.1 Problem

Instructors lack access to real-time insights about where students direct their attention during learning activities, particularly in large-group settings. Without this data, it is difficult to assess engagement, monitor collaboration, and adapt teaching strategies to improve the effectiveness of learning.

There is a need for a system that can capture and analyze group gaze data during classroom activities, so that instructors can better understand and respond to student attention and engagement in both synchronous and asynchronous learning contexts.

1.2 Inputs and Outputs

[Characterize the problem in terms of “high level” inputs and outputs. Use abstraction so that you can avoid details. —SS]

1.3 Stakeholders

Direct Stakeholders

1. Students
 - Their gaze data is collected during learning activities.
 - They benefit from potentially improved engagement and teaching methods.
2. Instructors / Professors
 - Use gaze-based analytics and dashboards to adapt teaching.
 - Participate in the research study and provide feedback.
3. Capstone Development Team
 - Designs, builds, and tests the integrated learning platform.
 - Works on solving technical challenges (e.g., real-time visualization, group data capture).
4. Researchers / Educational Technologists
 - Analyze gaze data to study engagement and collaboration.
 - Derive insights that inform system improvements and pedagogy.

Indirect Stakeholders

1. Future Students and Instructors
 - Benefit from refined teaching methods and improved learning environments informed by this research.
2. Industry Partners / EdTech Companies
 - Could leverage findings for commercial tools (e.g., learning analytics platforms).
3. University Administration (McMaster)
 - Gains insights into teaching effectiveness and innovations in classroom technology.
 - May decide on scaling or adopting such systems institution-wide.

1.4 Environment

Software Environment

- **Version Control and Collaboration:** GitHub will be used for source code management, issue tracking, project boards, and continuous integration/continuous delivery (CI/CD).
- **Integrated Development Environment (IDE):** Visual Studio Code (VS Code) will serve as the primary IDE.

2 Goals

1. Develop a Learning Platform
 - Integrate large-group eye tracking into both synchronous (live classes) and asynchronous (recorded or online activities) learning contexts.
2. Enable Contextual Data Capture
 - Log gaze data alongside classroom learning activities such as passive content viewing (e.g., watching videos) and active group work (e.g., exercises, discussions).
3. Conduct In-Person Research
 - Run a study with instructors and students at McMaster University to evaluate how gaze-based insights affect teaching and learning.
4. Inform Future System Designs
 - Use study findings to guide the development of features like instructor dashboards and real-time gaze analytics.
5. Tackle Key Technical Challenges
 - Address issues in system design, reliable capture of group gaze data, and effective real-time visualization of attention patterns.

3 Stretch Goals

1. Support more complex classroom activities
 - Extend the system beyond single-board, lecture-style classes to settings with multiple focal points (for example, group discussions or multiple boards), so it can handle a wider variety of learning environments.
2. Enhance real-time analytics

- Improve the live feedback available to instructors by going beyond simple engagement markers, while keeping the analytics lightweight enough to scale across many devices.
3. Strengthen privacy protections
- Ensure the system does not expose sensitive or personally identifiable information. This includes hiding personal details captured by eye cameras and preventing raw video feeds from being directly viewed by researchers or instructors.

4 Extras

[For CAS 741: State whether the project is a research project. This designation, with the approval (or request) of the instructor, can be modified over the course of the term. —SS]

[For SE Capstone: List your extras. Potential extras include usability testing, code walkthroughs, user documentation, formal proof, GenderMag personas, Design Thinking, etc. (The full list is on the course outline and in Lecture 02.) Normally the number of extras will be two. Approval of the extras will be part of the discussion with the instructor for approving the project. The extras, with the approval (or request) of the instructor, can be modified over the course of the term. —SS]

Appendix — Reflection

1. What went well while writing this deliverable?

Stanley: Writing this deliverable went smoothly for me. The reason for this is that I was responsible for creating the team charter (which is on the development plan document), which was a simple process where I came up with some reasonable responses and checked in to see if my team agreed.

Manan: Writing this deliverable went well because our team was able to communicate effectively and divide the work equally. We were able to discuss our ideas and come to a consensus on how to approach the problem statement and goals. This made the writing process smoother and more efficient.

Angela: After meeting with our supervisors and discussing the plan as a team, we were able to clarify and finalize the details for this deliverable. We also received supporting resources, including research papers and the GitHub repository, which helped us better understand the project requirements and identify the stakeholders it affects.

2. What pain points did you experience during this deliverable, and how did you resolve them?

Stanley: The only pain point that I experienced was making sure that everyone agreed with the expectations that I wrote (on the development plan document). One member said that if we should let our group know in advance that we will not be able to attend a meeting, that should be reasonable enough for him/her to not show up, which I updated in the expectations later.

Manan: One pain point was understanding what exactly the professors were looking for in this project. We resolved this by discussing as a team and clarifying any doubts we had with the professors in charge.

Angela: Since our supervisor was assigned closer to the deadline for this deliverable, we needed to accelerate our work and quickly build a strong understanding of the project. We resolved this challenge by holding an in-depth meeting with our supervisors, where we clarified expectations and addressed the sections of the deliverable that were initially unclear.

3. How did you and your team adjust the scope of your goals to ensure they are suitable for a Capstone project (not overly ambitious but also of appropriate complexity for a senior design project)?

Stanley: For the most part, we met up with our instructors and team members to discuss how much time and effort we could afford to invest. Through this, we were able to gauge exactly the scope of our project.

Manan: We adjusted the scope of our goals by discussing as a team and considering the time and resources we had available. We made sure to set realistic and achievable goals that would still challenge us and allow us

to learn new skills. We also consulted with our instructors to ensure that our goals were appropriate for a senior design project.

Angela: Initially, we drafted our goals based on assumptions drawn from the potential projects PDF. We later refined these goals by incorporating the rubric, lecture slides, and supervisor feedback, ensuring that they are both realistic in scope and appropriately complex for a Capstone project.