VCU College of Engineering

CS 25-313 Gamification of Extracurricular Participation in CS

[Project Proposal]

Prepared for

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Executive Summary

The Gamification of Extracurricular Participation in CS project aims to encourage student involvement within the Computer Science Department among clubs and department events by applying gamification principles. The project is meant to encourage more students within VCU's college of engineering by incentivizing proactive engagement through challenges, reward systems, and tracking participation. This initiative is designed to support current club members in strengthening their connection to the clubs while providing non-members with an accessible entry point to begin participating in extracurricular activities.

The primary objective of this project is to utilize data collected on the current participation level to develop a platform that encourages engagement within the Computer Science extracurricular department. By analyzing the involvement data and common trends seen within the student population and faculty, the platform would be tailored more towards specific aspects that would increase engagement among both club members and non-members.

To date, the team is in the phase of surveying students and faculty about the current participation trends within clubs and CS coordinated events. With this, the upcoming milestones involve developing a prototype that would tailor towards the current situation as what would encourage more involvement within the department.

The deliverable for this project would be a prototype of a gamified platform, that would acknowledge certain achievements when students have engaged with CS clubs or events and report a measurable participation rate among the activities.

Note: The Executive Summary should be updated between major reports as more knowledge is acquired and understanding of the project expands. For example, when submitting Preliminary Design Report in December 2024, make sure you update this page to reflect the progress on the project since the submission of Project Proposal in early October 2024.

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Section A. Problem Statement

The Department of Computer Science at VCU has provided on how there is a want for more participation within the student body, specifically from the Computer Science department using the idea of Gamification, surrounding the interaction with either clubs or CS related events. With students often not participating in the events available to them for reasons that we will look into. For non-membered students in our early research we can hear reasons that range from not knowing due to lack of promotion, to preconceived notions of already needing to have knowledge on the topic going on. Where for current members, we've heard the challenge lie with retaining member participation due to lack of structure, academic priorities, or limited benefits after joining.

This lack of participation presents challenges for non-members as it pertains to their lack of confidence in knowledge surrounding the notion that they should possess prior knowledge before joining certain events or clubs, causing a disconnect between them and the CS community within the school. For current members, it focuses more on sustaining their current engagement level and long-term involvement after their initial engagement. They often struggle to find continued motivation or increase levels of excitement after the initial meetings, as club activities start to lack importance when compared to other commitments, such as school and other non-CS related extracurriculars. The lack of active faculty engagement also highlights the issue of support and guidance when promoting clubs.

Gamification has been a concept used through different educational systems, in order to help see improvement in participation among their choice of study groups. It involved the usage of game design elements or patterns within an education context, commonly such as badges, rewards, leadership board… etc [3]. Our usage of gamification is to address the current issues of what students face when trying to learn about clubs and events or maintaining engagement once discovered. As it is crucial to follow appropriate educational methods and strategies, taking into account the students' knowledge, interests, unique characteristics, and personality traits [4]. Implementing specific methodologies within our design would ensure more long-term participation.

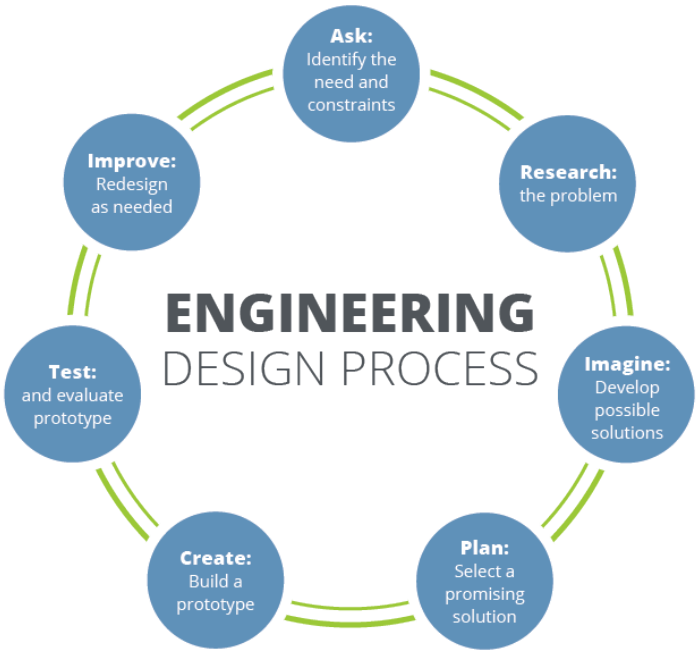

Figure 1. The iterative nature of the engineering design process [2].

Section B. Engineering Design Requirements

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

The project aims to boost engagement and participation within the Computer Science Extracurricular Activities Department using gamification. By gathering data about the current CS student population, it provides insight about the current situation to see where the usage of gamification can be used to help aid in the improvement of engagement outside their course load.

- To increase participation in extracurricular activities within the CS department through gamification techniques.
- To perform interviews with both students and faculty to gather data to better understand the current situation.
    - To collect and analyze data to understand the factors affecting participation.
- To create a well formed concept statement that aligns with the objectives of increasing engagement.
- To design a prototype interface that deals with a factor limiting student engagement in extracurriculars.

B.2 Design Objectives

The Design Objectives for the project focus on creating a prototype system that helps track student involvement and increase their engagement with clubs and or events, using gamification elements that focus more on key issues in regards to the current situation based on the collected data of the students and faculty. The final design will be decided upon the observations drawn from observing the current and past situation of clubs/events like our own.

- The design will be a prototype of a user-interface that allows for the user to access their attendance during CS club meetings or events in order to track their progress.
- The design will log the number of events or club meetings attended by each student
    - Allowed to record attendance and participation data to create reports that display trends of engagement
- The design will utilize tools such as ReactNative and Figma to help prototype a display to help visualize gamification
    - Develop a simple database to log attendance data.
- Interview students, club officers, and club advisors on what is needed
- Look at previous projects of a similar capacity and take notes on what currently does and does not work.
- Adjust vision based upon the data garnered from those observations

B.3 Design Specifications and Constraints

- Design must be simple to understand.
- Design must be mobile functional.
- Design must work within the decided specifications.
- Design must integrate gamification features in a meaningful capacity.
- Design must be justified with the research done on the subject.
- Design must be well documented with an easily understood timeline.
- Design must not exceed current budget.
- Design must focus upon data collected from Computer Science related events.
- Design must incorporate UX/UI components during prototype design.

B.4 Codes and Standards

List all specific codes and standards that are relevant to the design providing specific details of each as they relate to the design. While the terms codes and standards are often used interchangeably, there are in fact important differences in their definitions that should be understood. **Standards** are documents that provide a set of technical definitions, instructions, rules, guidelines and/or characteristics of a product, process, or service meant to provide consistent and comparable results (e.g. performance requirements, dimensions, testing procedures, file formats etc.). They allow for interchangeability of components and system interoperability and are typically produced by industry or professional organizations such as ASME, ANSI, ASTM, IEEE, ISO, ACM, IAPP, AIS, etc. Standards are meant to help ensure quality, reliability, and safety.

Codes are laws or regulations that specify the methods, materials, components, etc. required for use in a certain product, process, or structure. Codes have been *codified* into a formal written policy or law and can be approved at the local (municipal), state, or federal level. While standards provide sets of guidelines, codes are constraints that *must* be met in accordance with the law. It is, however, common for codes to reference or require the use of one or more standards. Some common code producers include the EPA, OSHA, DOTs, and the NFPA. Codes help set minimum acceptable levels in order to protect public health, safety, welfare.

Codes and standards are often listed by their producer followed by an identifying numerical code. They often contain hyphens or periods which may help reference specific parts of a larger code/standard or provide the year of the latest revision. Some general examples in a list of codes and standards are as follows:

- ASME Standard No. xxx – design must consider some specific fatigue failure criteria
- IEEE Standard No. xxx – design components must not exceed some maximum current limit
- ISO Standard No. xxx – design components must adhere to some standard thread size
- OSHA Code No. xxx – operators of design must wear appropriate eye and face protection
- IRTF Standard No. xxx – design must consider internet communication protocols
- W3C Standard No. xxx – design must adhere to some HTML/CSS standards
- NIST Standard No. xxx – design must consider some specific data security standards

Note: Relevant codes and standards should be incorporated into the design specifications and constraints listed above.

Section C. Scope of Work

C.1 Deliverables

- 1 report about the current state of attendance and retention of Computer Science club members, which will include:
    - Interview data of interviewed stakeholders
    - Work Activity Affinity Diagram (preferably converted into a digital form for record keeping) organizing the various keywords and phrases gathered from the interviews.
    - Representative set of personas of major user archetypes for both clubs and events.
    - One or more usage models that show how the club/event attendance, interaction, event planning work, and barriers (one for the current situation and one for the envisioned situation)
- A list of work roles and who (Students/Members, Faculty/Advisors, Organizers) and/or what systems (Gamification features) fulfill each of these work roles
- A set of mandatory design requirements for the system that is well cited and based on existing data (these are the things that NEED to be supported, not necessarily features we'll add to enhance the envisioned experience)
- Multiple Scenarios/storyboards comparing and contrasting the current situation and the envisioned situation
- At least 3 very different conceptual designs with descriptions and justifications as to why one was chosen over the rest
- Evaluation of the finally decided upon design with accompanying data
    - 1 prototype of the user-interface
- A set of software design requirements for the system based on the design and evaluation
- A Fall design poster.

C.2 Milestones

- By Mid-November we will have an analysis of our data to come up with possible solutions to increase extra curricular engagement.
- By the end of November, at least 3 storyboards will be created based on data collected from stakeholder interviews
- By the start of the Spring semester we will have a conceptual design of what a working prototype might be.
- In the first quarter the Spring semester we will have committed to a solid conceptual design/statement for the problem statement
- During Mid-Spring, a mockup prototype will be created
- End of Spring, Capstone Expo and presentation of our final product (being a prototype gamification design)

C.3 Resources

- To be determined through the process of creating the final prototype(s)

Section D. Concept Generation

A number of methods can be used to help generate design concepts from simple reflection and brainstorming, to working the problem backwards, using reverse thinking techniques, and looking to nature for inspiration (i.e. biomimicry). Existing solutions, or components of existing solutions, can be substituted, combined, adapted, modified, put to other uses, eliminated, or rearranged to meet new design objectives and specifications. A minimum of 3 overall design concepts is required for this section although more are welcome. Provide a brief description of how each design concept addresses the design problem. Discuss the potential pros and cons, including and potential risks of failure, of each of these concepts.

It is likely that each design concept may consist of several components. In this case, one or more of these components may offer a sub-problem that can be further explored, modified, or otherwise improved upon. These sub-problems may lead to the addition of several additional design concepts and may require the inclusion of a design concept chart or matrix to organize all ideas and potential solutions.