Mission Management
Project Proposal
COMS 6901 E sec 028
Fall 2017

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1. Introduction

Our primary motivation during this project is to take previous researcher's work in Gameful Affinity Space and add a higher degree of gamification for the students. Gamification is the buzzword for adding gaming elements such as points or badges to learning experiences to make them more engaging and to increase motivation[1]. We want to introduce Missions, Games and Quests as a step in this direction[2]. The gameful affinity space that we envision will have ways for teachers to create and assign Missions to the students. Each mission will have multiple Games where student learns the new concepts and at the end appears for a Quest which will be a gamified version of assessments. Teachers will be easily able to create missions, games and quests; and maintain them effectively in their respective libraries.

Education for children is a topic that has been widely researched and debated. It involves the mingling of numerous disciplines like psychology, human behaviour, technology etc. With the advents in science and technology, experimenting numerous options and styles in education system to perfect it has become a trend. One of the major areas of education research is towards development of proper formats of teaching computer science and computational thinking concepts as these fundamental concepts are generally challenging to be taught in a regular classroom environment. Computational thinking involves solving problems, designing systems, and understanding human behavior, by drawing on the concepts fundamental to computer science. Computational thinking includes a range of mental tools that reflect the breadth of the field of computer science [3]. Visual interaction methods of studying with the addition of some kind of incentivised approach have been widely acclaimed as a constructive tool in helping students learn. There are numerous experiments to corroborate this. Also, simple educational games have been shown to be both efficient in capturing the attention of students and teaching them in an engrossing and enjoyable manner. While these visual interactive techniques are in general a useful instrument for education, they are especially helpful in teaching computational concepts and computer science fundamentals.

Designing a Collaborative Game-Based Learning System to Infuse Computational Thinking [4] discusses how gamification in the teaching of computer science concepts to people from different backgrounds has proven very efficient. For efficient education, a platform is required which in addition to gamification provides a similar level of interactive interface to the traditional education system. An interface that

is intuitive enough for both students and teachers for an effective learning of CT concepts for the students. An interface where the student not just learns, buy receives valuable feedbacks, badges as incentives, recommendations and hints during numerous stage of his Mission, formerly known as learning path. An interface where the teacher can monitor student's progress, provide feedbacks, assign missions, create new games and quests. SAGE (Socially Addictive Gameful Engineering)[5] intends to create the perfect platform by combining all these elements to form a collaborative game based learning system which infuses computational thinking into young students in a highly intuitive and integrated manner.

We intend to build upon the work done by previous researchers in the domain of gameful affinity space [6] to create the aforementioned platform. We intend to change the formerly known learning paths to missions, which will contain games and quests. Going ahead, our focus will be on the ease of creation and maintenance of each of this components for the teacher.

2. Related Work

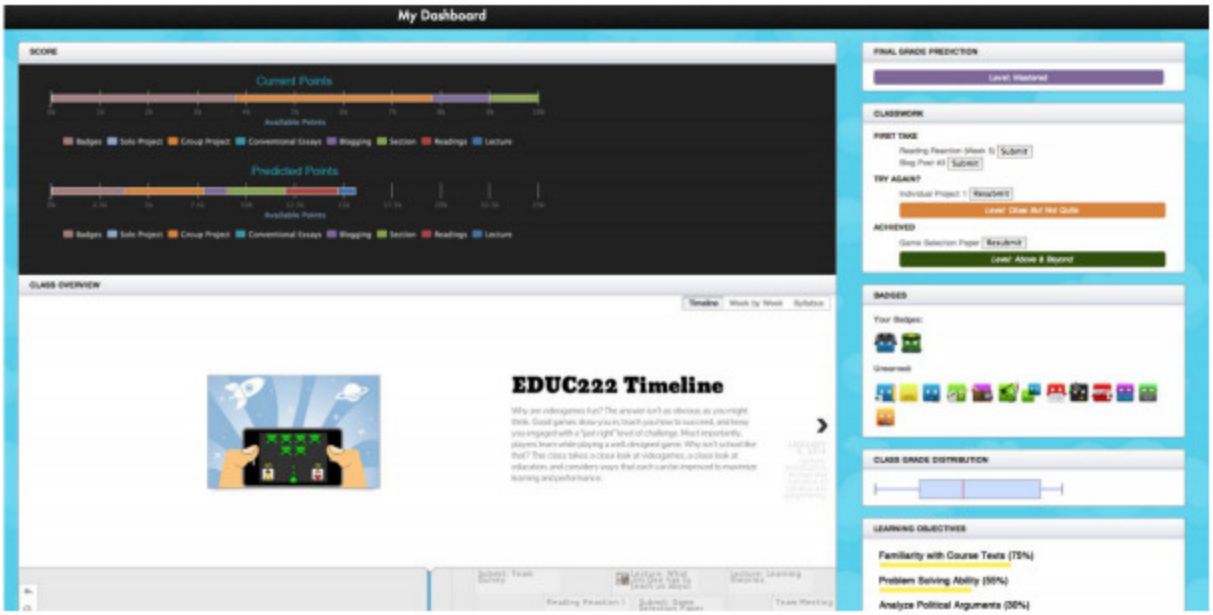
2.1 GradeCraft

GradeCraft (Holman, C., Fishman, B., Aguilar, S. 2013) is a game-inspired learning management system. It has two dashboards : one for students and one for teachers. The motive behind GradeCraft research is that the game-inspired courses are developed in an effort to increase student engagement, and to provide students with more personalized learning experiences. At the same time, it gives instructors new insight into student engagement, and provide data-driven ideas about how to tailor their course to student needs.

2.1.1 Student Dashboard

The paper discusses two perspectives, one each for the student and the teacher. A screenshot of the Student Dashboard is displayed below. It is showing numerous details about the progress of the student. It also shows the badges that student has won, points in various assignments, predicted points using which student can actually model his/her grade. This information has a motivational effect on the students, as preliminary research indicates that this type of display boosts user motivation to complete tasks (Kohler, Niebuhr, & Hassenzahl, 2007).

The dashboard also shows a to-do list for upcoming assignments, assignments that could be re-submitted to improved performance, progress towards achieving the course learning objectives, and distribution of student's own performance against his/her own peers.



2.1.2 Instructor Dashboard

The second perspective is the instructor perspective. When initially setting up a course in GradeCraft, instructors can declare the overarching learning objectives. As they create assignment types and badges, each one can be tagged with the relevant learning objectives. Instructors can create badges and each badge has varying level of difficulty to achieve it. This is similar to our approach of implementing quests, where students can complete various quests and win badges.

A screenshot of Instructor Dashboard is shared below. It provides comprehensive details about the class within a single view. GradeCraft equips the instructors with tools and metrics to better manage the gameful structure of the class itself. It shows the top and bottom percentile of the class in form of the stacked bar charts. This assists instructors to identify the students in need earlier. A box and whisker plot is used to capture the overall class performance, displaying the range of achievement as well as situating how the majority of students are doing.

2.2 MOOC Platforms

MOOC (Massive Open Online Courses) platforms, are proving to be the game changers for higher education and employee skill-set development. By offering free online courses on number of topics, through quality instructors and universities, they are providing learning and development to virtually everyone, anytime, anywhere in the world with internet access. One of the things that MOOC platforms, like Coursera, are really efficient at, is the ability to recommend courses based on participants' features, such as past courses and interests.

For example, if a participant is shown to pursue Computer Science courses in the past, he or she is more likely to get a recommendation of CS courses. We see an opportunity to use a similar recommendation system described later in the following sections. These platforms also provide excellent learning paths for "degrees" in particular topics. These topics often contain several related courses, modeled in way to advance from beginner to higher levels. MOOC like Khan Academy provides gamification through a knowledge map, which shows the user a map of all the videos that he/she needs to watch to learn each subtopic of a course. This is similar to concept of a mission and games. A mission contain multiple games, may be one inspiration we can draw from this is to implement a similar kind of map for each mission which provides a higher degree of gamification to students.

2.3 Canvas

Canvas is the new version of Courseworks, and currently used in numerous universities for course tracking. It provides a beautiful interface for tutors. They can upload various reading materials, make creative assignments and interact with the students.

3. Proposal

3.1 Features

The project will include the development of three different libraries along with improvements of the partially implemented assessment creation. The libraries are Teacher Mission Library, Teacher Quest Library, and Teacher Game Library. For each of these libraries, the teachers will be able to browse and search through the missions, quests, and games created by the community respectively.

3.2 Instructor Dashboard

The instructor dashboard is the primary interface for the teacher and instructors to interact with SAGE. The instructor dashboard provides the performance of the class within a single view and an interactive environment where instructors can login, create courses, missions, and design assignments as well as assessments for other students.

For this proposal, the features of browsing and searching Missions, Quests, and Games will be implemented. To do this a collection of Missions, Quests, and Games will be available for the instructors to simply scroll through and be able to filter out and find something that works best for their classroom.

3.3 Creation of Assessment

Assessments are a unit of education in SAGE. Each assessment tests a subject at a particular mastery level. The creation of assessments are done by instructors. Instructors can choose to create an assessment based on other assessments previously created by others in the SAGE community.

The creation of Automatic Assessments has been discussed in previous semesters. It was mentioned of using Visual Assessment Editor that lets the instructor

design assessments for the assignments. The VAE was earlier a separate component that the instructors had to access with a different server. However, now with the dashboard integration, they can create these assessments in VAE from the platform itself.

Clicking on any course takes us to the course page with all the assignments under that course clearly listed. Clicking on any of these assignments takes us to the VAE where instructors could design assessments. This needs to be improved so that instructors could more clearly understand that each assessment created is associated with an Assignment when saved.

In addition, the feature of game type to be specified on creation will allow instructors to specify the type of game they are about to create as a Parson's Puzzle, Constructionist Game, or Boss Game. Hence, the appropriate SAGE features will be enabled. This will be a drop down list in the instructor game creation that they will be able to choose from. The addition of this feature will allow instructors to more quickly create various types of games from scratch.

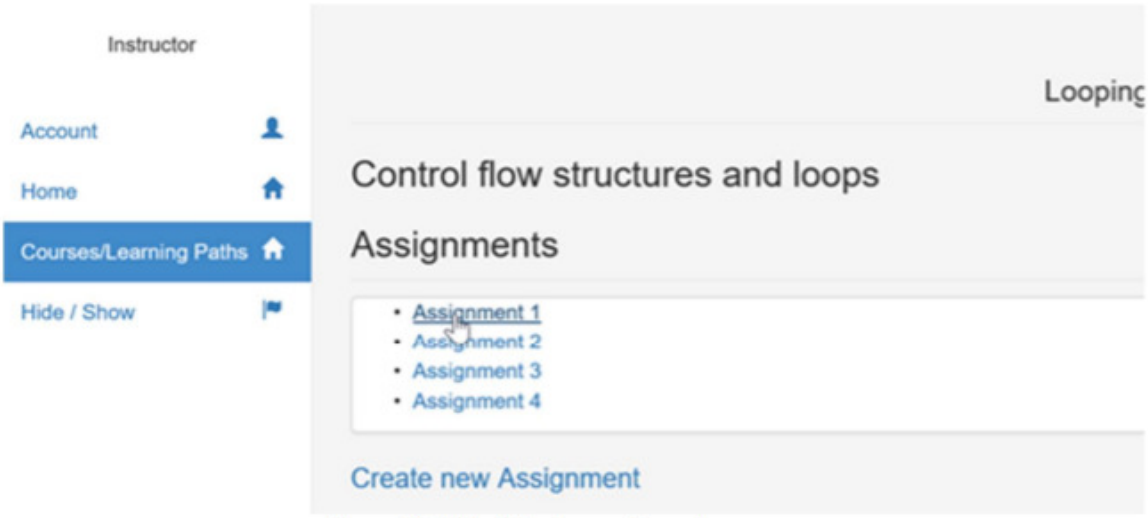
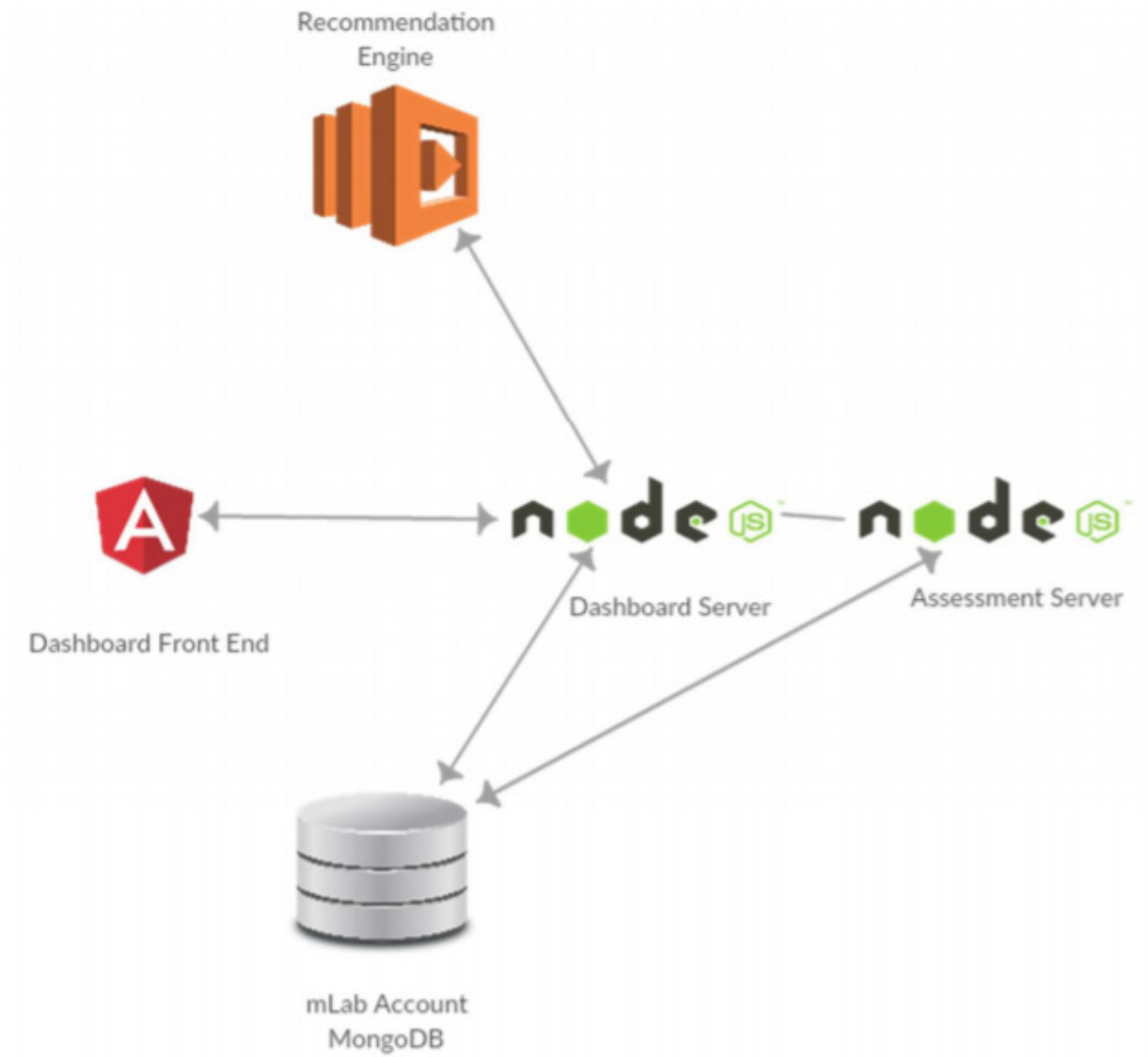


Figure 13. List of Assignments under a course

Figure 14. VAE integrated into dashboard

3.4 Architecture



The diagram above depicts a high level architectural diagram of the Computational Thinking Platform. It is a single page web application with front end developed in AngularJS. It receives the data in JSON format from Dashboard NodeJS server through series of AJAX calls REST APIs. The Assessment Server microservice handles the data associated with storing the files related to assignments' creation and design and students' progresses, and running evaluations using the Hairball plugin. Dashboard server receives the recommendations to through a separate Recommendation Engine deployed on AWS Lambda. All the structured data is stored in MongoDB.

4. Timeline

Table 1 below outlines the various milestones through each sprint along with the end date of each sprint. Dates are also defined for midterm and final project deliverables.

Sprint Number	**Milestone**	**Sprint End Date**
Project Proposal	Project Proposal	September 29th, 2017
0	Environment Setup	October 13th, 2017
1	Mission Creation, Assessment Creation	October 27th, 2017
2	Teacher’s Mission Library	November 10th, 2017
3	Teacher’s Game Library	November 24th, 2017
4	Teacher’s Quest Library, Final Report & Presentation	December 8th, 2017
5	Final Report & Presentation	December 22nd, 2017

Table 1: Proposed Milestones Completion Dates

5. Conclusion

The SAGE platform provides a highly innovative and interactive way to teach computational thinking to young students. The entire process of interactive education is based on gamification and game based learning. Hence, it is imperative that the system is encompassed in a platform that is highly intuitive to use both for the students and teachers.

The features and design of SAGE have been done with the idea that it could be used as a global platform for education of computational thinking concepts. The gamification such as quests and missions make it easy for students to navigate the platform and develop their understanding through the educational games. The platform of SAGE built upon tools like Scratch make this possible for a global audience. As the research and technology in this field is never constant , we have made the platform as robust as possible to accommodate future changes and development with ease.

6. Future Work

There are many diverse avenues for widespread development and research in Scratch. Many features have been laid out in the epic, and following are some features that can be done in the future to enhance SAGE. A feature proposed that could be enhanced further is the game type specified on creation is a feature where instructors can classify games they are about to create as a Parson's Puzzle, Constructionist Game, or Boss Game. This is so that the appropriate SAGE features are enabled. The feature could be enhanced by allowing instructors to have more specific pre enabled features upon creating new games from scratch.

Game edit version control is a feature where instructors can make new versions of games they create from older games so that they do not lose the context for games students have previously played. Game version filtering is a feature where instructors can see the current versions of games displayed, so that older games do not litter the game browsing. Finally, the assessment edit version control feature can be created so that instructors can create new version of assessments, and do not lose the context for assessments students have previously completed.

7. References

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