

**School of Computing and Informatics** **Decision Systems Engineering   
Computer Science and Engineering Capstone Faculty Project Proposal**

1. **Contact Information**

**Faculty Contact Information**

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**Project Contact Information (if different from Proposer)**

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1. **Project Description**

**a. Project title:**

Collective Reaction: an intelligent agent for affective adaptation within video games.

*Team Focus*: the adaptive data framework (ADF) and Affect Bot.

**b. Project description:**

Interactive digital entertainment has long held the precipice for delivering brand new, immersive, and jaw dropping experiences. From the legendary Call of Duty franchise to the simple ingenuity of Minecraft and casual mobile games, these interactive experiences take on many forms but all share a similar trait: they all require some form of **input** from a **player** to work properly.

Most cases of player choice and engagement can be attributed to the game stimulating seemingly random permutations of keyboard, mouse, or gamepad input. Another variable is the **emotional response** of the player as a function of time. This is a function that, when crossed with the player’s raw physical input, contains incredibly valuable insight about the game’s **impact** on the player and the **reasoning** behind the player’s **meaningful** interaction. Capstone teams are needed to create and maintain software infrastructure that reads, analyzes, and facilitates the study of this composite function so that the player’s affective state can be **accurately** **manipulated** in real time. There are a variety of opportunities within this objective for multiple software teams.

Students that are passionate about mathematics, artificial intelligence, data analysis, software abstraction, theoretical computer science, and meta-architectural systems should consider working on the ADF and Affect Bot. This is the central “brain” of the system and will be responsible for evaluating large data sets in order to make good adaptive decisions. This is a very abstract system; it is targeted for all game genres and each genre brings unique challenges to the entire problem. Working on this project will require learning an existing code-base and is fundamentally a research project.

**c. Deliverables:**

By the end of the year, this team will deliver a complete **data processing solution**. Students must understand that this project is a challenging capstone and will require a significant amount of effort from the entire team. Given the rapidly changing requirements of this system, the team may be subdivided to work on smaller components including but not limited to:

* Data Processing Models: spend time running subjects through carefully planned test cases and analyzing stored data to better discretize the affective data stream into key events. Refactor the code-base to enable such features.
* API Integration: study affective APIs provided by third parties (Adas PAD, Emotiv, ABM, etc.) and create a universal plug-in wrapper for the system. The idea is to consolidate the system to one POI (point of integration).
* Decision Models: use AI concepts to improve Affect Bot’s decisions and achieve *testable* results.
* Migration: if necessary, move the current web platform to the cloud, such as Amazon Web Services.
* NoSQL/JSON Database: this system needs to process a lot of data, very quickly, and warrants research into current database design principles for structured and semi-structured schemas. Investigate current database implementations and big data systems (such as Apache Hadoop) and **IF NECESSARY** create a brand new database for the project.

We will be encouraging students to present their work on international conferences as a demo, poster, or short paper. If student work is accepted for presentation, we will support them to attend (travel to) the conference.

**d. Motivation**:

* Create a centralized, collectively intelligent system that can make adaptive decisions, fire adaptive events, or optimize player affective state on-demand.
* Aggregate in scale how gamers are processing input decisions and how these decisions vary based on genre.
* Start the next big thing for commercial video games.
* Transfer the knowledge and data from this project to other projects such as bioinformatics and medical systems, quality of life, intelligent tutoring and education initiatives.

**e. Student learning experience:**

This project represents a singular real-world experience for students in several aspects, including:

* **Solving real-world problems with state of the art technology.** We aim to create a singular opportunity to live a real world experience where creativity is encouraged but boundaries in the organization artifacts are defined. Students are going to be building an innovative technology that could improve human life.
* **Teamwork Experience**. Students will grow their teamwork skills working in a project where new requirements drive the creation of new software components. Students will use their analysis, design, programming, testing, and project management skills, collaborating with their team mates but also with mentors and researchers.
* **Component-driven pattern-based development**. As a developing team, we work under a component-driven approach. Student responsibility goes beyond programming and documenting; it will be required that design and implementation follow the component-driven approach, use design patterns, and satisfy organization rules. The goal is to create a product but also assure that what is done will be the basis for future work.
* **Research work experience.** Students will be collaborating with researchers and will be encouraged to get involved in research activities, such as paper writing, poster design, and conference presentation.

1. **Required background:**

It is expected that participating students have the following skills:

* Software development background with an emphasis on **object-oriented programming**.
* Experience with source control and collaborative tool chains (bug tracking, etc.).
* Strong database background.
* Experience with both SQL and NoSQL databases.
* Experience with XML or JSON databases.
* Strong C/C++ skills. Other languages such as .NET/C#/Java will be useful.
* Experience with the R statistical language.
* Experience with MATLAB, Tableau, or similar software.
* Experience with the Qt Framework will be a huge **plus**.
* Experience with RESTful web services will be a huge **plus**.