CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title: Gesture-based engagement station for STEM recruiting in K-12	
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Project Overview:

With leadership on the world economic stage increasingly tied to technical innovation, encouraging middle and high school students to pursue careers in STEM (Science, Technology, Engineering, Mathematics) is more important today than it has ever been. Research shows that middle school (some say even earlier) is the time when maturing students tend to make up their minds about if they'd like to pursue STEM or not. This is exactly the moment, therefore, when young students need to be presented with a clear, attractive vision of what careers in STEM are possible, what you actually do in those kinds of jobs, and how to prepare yourself to move in that direction. Unfortunately, there are almost no STEM-centered informational materials available that are designed for this "early entry" cohort and for their teachers and school counselors...and even fewer materials that are presented in an engaging and technologically interesting way. The aim of this project (which is supported by a generous equipment grant from a corporate sponsor) is to explore ways to address this shortcoming, resulting in an interactive, gesture-based interface to informational content designed for large displays (e.g. projected on a wall) for audiences of 5-20 interactively engaged participants.

Our vision of an ideal product is a highly graphical informational interface that can serve to drive both standard desktop interaction (e.g. access via a web browser) for traditional 1-2 person audiences, as well as (the more interesting challenge) a large audience interface in which the graphical content is projected onto a wall or large screen, and audience members can step (literally) into a "control space" to interact with the interface through gestures. For instance, the interface might consist of a variety of graphical "information containers" (e.g. labeled colored boxes, or nodes in an informational graph); these boxes could be pointed to/selected via a pointing gesture, could be opened, say, with a swiping or expanding gesture, and the contents further explored in similar interactive ways. Once the basic gesture-based interaction and graphical content-space is

completed, the team will be encouraged to contemplate various “gamification” elements, e.g., some sort of game or competition to engage and motivate multiple actors in exploring the space.

While the details of system technologies and architectures will be up to the team to explore, propose, and develop, we envision the gestural elements to be driven by the well-known Xbox Kinect input device, which is cheap, freely available, and has a powerful and well-documented API for third-party programmers. We would be open to considering other options, however, if the team discovers newer technologies with the appropriate capabilities. Specific functions targeted for the product include:

- An extensible framework for graphical packaging of information content, i.e., ability to specify some graphical layout (e.g. a jpg image) plus a way (e.g. Json file) for associating labels/content within each for display on a screen; plus an editor of sorts to allow non-technical users to create content.
- A web-based framework for exploring the information space in a conventional way, i.e., on a standard screen using a mouse.
- A projector+Kinect+computer-based display in which the graphical content display is projected onto a portable screen, and users interact with it using gestures that are picked up and mapped by the Kinect.

A basic solution (minimal viable product) will provide a custom-made graphical representation of the STEM-recruiting informational content provided by the sponsor, and allow smooth interaction with that content using both on-screen and projector+Kinect displays. A more complete solution will provide a simple “editor” that allows end-users to create/edit their own content; as well as exploring some of the fun gamification aspects on this problem. Such a system could provide a nice open-source solution for anyone looking to create a gesture-based information system, and could have broad usage/impact reaching far beyond this particular project.

Knowledge, skills, and expertise required for this project:

The team will likely need to have or acquire skills in:

- Design of modern web applications, including web-based GUIs.
- End-user interface design, testing, and refinement processes.
- Expertise in gesture-based GUIs, particularly using Kinect or similar input device.
- Ability to work with non-technical client to extract requirements and develop product.

Equipment Requirements:

This project certainly has specialized equipment requirements, but these will be provided for by the client, based on recommendations of the team. Equipment will likely include:

- Access to standard development stations, IDEs and other software development tools. These should be freely available; the team is expected to provide for themselves here.
- Access to a web server for hosting a potential webapp to drive the traditional screen-based GUI, allowing end-users anywhere easy access to informational materials.
- A screen, projector, and one or more Kinect devices, plus a computational platform to drive the system. These will be client-provided.

Software and other Deliverables:

- The webapp version of the informational system outlined above, installed on a server of the client's choosing and tested/verified.
- The projection-based version of the informational system outlined above, packaged in an easy-to-install/deploy form. Must include detailed "user-manual" for (a) creating/editing content and (b) setting up the mobile system for action.
- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally-documented codebase, delivered both as a repositoty in GitHub, BitBucket, or some other version control repository; and as a physical archive on a USB drive.