



FINAL REPORT

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## RECAP: REALITY CAPTURE AND SIMULATION FOR DESIGN EVALUATION

### Overall Project Goals and Evaluation Criteria

Our team had set the following project goals and these form the evaluation criteria for our progress report:

- Implement the necessary hardware and software infrastructure for motion capture and agent simulation
- Conduct training workshops for students
- Document workflows for behavioral simulation and publish a technical report
- Develop a small library of agents and demonstrate proof of concept simulation for evaluating behavior in a spatial environment.

### Summary of Accomplishments

#### Software and Hardware Implementation

We have successfully procured and implemented a 12 camera motion capture system from NaturalPoint Inc. and the intelligent agent simulation software from MassiveSoftware Inc. in Spring 2013 semester. We showcased these technologies as part of the Immersive Visualization Lab open houses in Spring 2013 and Spring 2014. We did not implement the Vuzix augmented reality glasses as the landscape of AR technology is rapidly changing and we see more affordable systems available in the near future which are more compatible with our workflow.

#### Training

The project PI offered an elective course in Spring 2013 on *Advanced Visualization* to 12 undergraduate students and 3 graduate students. Last five weeks of the course introduced motion capture techniques and agent simulation techniques. This provided students an opportunity to incorporate these tools for visualization and simulation. A small group of students (both graduate and undergraduate) also received training in using the motion capture equipment and behavioral simulation. Two undergraduate students have received the P.U.R.E. (Program for Undergraduate Research Experience) scholarship from the college of Human Environmental Sciences to develop virtual models of a hospital environment during Summer 2014.

#### Development of Proof-of-Concept Demonstrations

As part of the advanced visualization course, two proof of concept demonstrations were developed. One student team undertook human-factors and ergonomics research at the simulation lab in Sinclair School of Nursing. We successfully modeled a portion of the environment in a hospital room, captured movements from an actor portraying a nurse and successfully mapped it on to a virtual character in the 3D hospital room environment. We also created a small library of motion capture data.

We developed some basic demonstrations of small crowd and vehicle simulations in MassivePrime. In additions to MassivePrime, we also explored Populous feature of 3D

Studio Max and Anima for crowd simulations. While the MassivePrime has very sophisticated capabilities compared to the other two, we found that the learning curve was steep.

With additional funding from MizzouAdvantage we have leveraged our motion capture and behavioral simulation tools to develop simulation models of emergency scenarios. Over this semester, we have modeled Gwynn and Stanley Halls and developed agent-based simulations of crowd behavior. We are improving the quality of the simulation working with colleagues. These proof-of-concept demonstrations were showcased as part of the iLab Open House on April 25<sup>th</sup> and April 27<sup>th</sup>.

#### Documentation of Work Flows

We have documented the workflow from capturing movement to integration to our 3D authoring software for internal use. This is used by our team and current students involved in the iLab. We are continuing to work on a detailed technical report/ user manual that list the process in detail and best practices learned from our explorations.

#### **Ongoing Work beyond Objectives of the grant**

While we have accomplished our primary goals as described above, we are building on both the infrastructure and the skills acquired through this project. We are ensuring that the impact of the grant extends beyond that of the funding period in three ways.

- The technology and software is integrated into curriculum through the advanced visualization course offered through Architectural Studies department
- Graduate and undergraduate students have an opportunity to use the motion capture technology and simulation software through independent study projects and other opportunities like the Program for Undergraduate Research Experience
- We are exploring grants both within the UM System and outside to utilize our capabilities for behavioral simulation. These include the recent MizzouAdvantage grant and another one with UMKC that is in the proposal stage.

#### **Expense Report**

The grant funding was used to purchase the following:

• OPTitrack Motion Capture Infrastructure	\$ 18,427
Included 12 Flex-13 cameras, six tripods, Optihubs, associated cables and peripherals and Motive software	
• 5 Licenses of Massive Prime Software	\$ 5,999
<b>Total Expenses</b>	<b>\$24, 426</b>
<b>Remaining/ Unused Funds</b>	<b>\$ 522</b>