The GMI™ Lab

by

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This report outlines the contribution of the GMI lab for last three years, and future projections for next three year based on the approved EAS Policy: EAS-FAC-0008 which specifies the following criteria (i) ICR generating grants, number and quality of external research grants, (ii) Student research training as it pertains to thesis, projects which include GMI Portfolio credit hours generated, and (iii) Instruction.

The GMI Lab (i) research over the last year was focused on starting several projects in the area of interactive-media, particularly generative systems, graphics, VR, and wearable computing with emphasis on medical visualization using cellular automata and complex systems. GMI Lab is pursuing Haptic work with Touch of Life Technologies; interaction with Sanborn; Infotainment work with Jaguar Land Rover. We submitted research proposals to Bio-frontier institute at UCCS ($24908), Google Research ($60,000), and to NSF ($296,233). Several (13) papers for publication were submitted, nine were accepted. Three of those nine were significant papers according to department criteria (30% or less acceptance rate). Four other separate papers out of these nine are invited for journal publication by the conference where they were published; An invited Chapter for a book entitled "On Large Displays for Medical Applications" is under review by German Book Publication. Weekly GMI Consortium meetings in Fall and Spring 2013 were organized. Dr. Semwal attended Strategic Grant Development writing workshop in February 2013. New area of research in ocean simulation using Cellular Automata started last semester. We continue to work on raytracing, shadows, medical visualization, complex systems, and wearable computing. Researched platforms (Unity3D, Maya, Optix CUDA. CARMA Chip NVidea).

GMI lab received several gifts (a) software gift of Medical Visualization Program provided by ToL technologies to the GMI lab. The industry version of this program is used for anatomy education and conduct medical simulations (http://www.toltech.net/). (b) Jaguar Land Rover Limited’s Mr. Matt Jones provided the Nexcom NDIS-166 (http://www.nexcom.com/Products/multi-media-solutions/digital-signage-player/high-performance-player/sandy-bridge-player/ndis-166) with a touchscreen as a loaner to the GMI Lab (Thanks to Chris Heisted). (c) NVidea donated their CARMA Chip set to the GMI Lab for raytracing research.

Organized the Technical Program Committee (TPC) work using the EasyChair system for the EPCA-McGMI 2013 conference as General Chair (Jan 2013). Dr. Semwal was technical reviewer for ACM Journal Transaction on Spatial Algorithms and Systems -- a new ACM journal -- Editor Dr. Hanan Samet. Dave Hardee served as President of Game Developer's Club. Dr. Semwal was invited by National Institute on Disability and Rehabilitation Center (NIDRC) invited me to join as list of reviewers.

1 GMI is Masters of Science in Computer Science Focus Media Convergence Games and Media Integration
The GMI graduate program now has almost doubled the program strength to seven students over last year. Four students graduated last year. We released a math learning game called 24 points (Li Ping’s MS Project), a mathematical game, for free download from my website, specifically for the visually impaired students. Learned Easy-Chair conference management system for organizing conferences. EPCA-McGMI 2014 conference, although cancelled due to other reasons, was a great learning experience. The GMI Lab continue to participate in EAS Open houses showcasing most recent projects and GMI portfolios of students. A conference is in planning stage for 2015. We also, for the first time looked at modeling social issues facing the society such as bullying (MS Thesis George Mudraks), and started work on ocean modeling and its environmental effects.

(ii) Thesis, Project, portfolio, and provided independent study guidance to 24 students, including six PhD students, and meeting with them weekly. MS Thesis/Project, and independent study Fall 2012-Fall 2013 (inclusive) Thesis: 60 Independent Study: 21. Distribution in 2013 was: Spring 2013: Thesis 19; IS 9; Summer 2013 : Thesis 6; IS 0; Fall 2013: Thesis 30; IS 3.

GMI Lab supported student research training for 20-25 students. See attached list of students which include PhD-CS, MSCS, MSCS-GMI students, and GMI Portfolios. In addition, GMI lab supports the independent studies for CS and BI-GDD undergraduate students. Four MSCS and MSCS-GMI thesis were completed in 2013. GMI Lab produced its first successful production teaming with TheatreWorks™ (Inspector General and Seagulles 2010).

(iii) Publications and GMI Facts:

GMI/CoView Data lab were featured in local Gazette UCCS initiative aims to engineering funds, businesses, and jobs (http://www.gazette.com/articles/initiative-128785-jobs-colorado.html). GMI Lab and consortium members organized three Crossover applications conference (with two articles in UCCS-Communique and reprint in Colorado Department of Education newsletter). Dr. Pamela Shockley-Zalabak, UCCS Chancellor opening the first conference in 2010 mentioned “This is exactly the thing UCCS should be involved.” (c) Free 3D Games donation based download for the Visually Impaired web-site launched -- (http://www.cs.uccs.edu/~ssemwal/poker_game_description.pdf; https://www.cu.edu/content/semwalteamingtechnologyimproveeducationblind) with games developed by UCCS student.

GMI Lab directly supports the instruction of graduate and undergraduate students through at least 8 courses in a three-year period cycle offered by Computer Science department. In 2013, more than eighty students enrolled in classes supported by the GMI lab. Following is the list of papers published in 2013 from the GMI Lab:


(3) (invited for journal publication) Mounika Namburu and Sudhanshu Kumar Semwal, Voice Morphing for the B/VI Community, MHCI 2013 1st International Conference on Multimedia and Human Computer Interaction conference, Ryerson University, 107, pp.1-6, Toronto, Canada.


There are five manuscripts under preparation at this time.

**26 MS/PhD thesis Students supported by the GMI Lab in 2013:**


4. Ryan Thomas, PhD Student, Ray Tracing GPU.

5. Nick Sterling, GMI Student, MS, Multi-projection system interaction (re-activated into the GMI program)

6. George Mudrak, MSCS completed Fall 2013, entering PhD program in Complex Social Systems.

7. Mike Bolei, Haptics/GPU systems/Visually Impaired

8. Joshua Hendricks, Neural Interface (NIA); Graduated MS Fall 2012.

9. Dee Dee Rich (MSCS-GMI) program, started Fall 2012.

10. Brian Wilke. MSCS student, Physics based animation; Graduated Fall 2013.


12. Irvin Rynning, GMI Student, Sound and Image.

13. Ping Li, MSCS (GMI) student: 3D Games for the B/VI community. Graduated Fall 2013.

14. Kaushik Banerjee, MS student, GPU visualization using OpenCL

15. Matthew Deschel, MS Student (inactive since Fall 2011).

16. Jonathan Metzgar, PhD. student, Interactive real time shadow maps

17. Ismail Bahkali, MS Student, Baloot game expected graduation Spring/Summer 2013. PhD Security student accepted.

18. Steven Ashworth (MS/PhD CS student): started Fall 2012.

19. Manu Garg (MSCS-GMI) started Fall 2012.

20. Abdullah Almuryh, PhD CS, Cultural impact and visually impaired, started Fall 2012.


22. David Hardee, MSCS (GMI), Games

23. Omamah Hawsawi, MSCS student, VR for disability expected to graduate Fall 2014.

24. Joshua Lawson, MS Student, Graphics (Ray Tracing)

25. John Promersberger (MS Student) GMI Research

26. Doug Ellison, MS CS, User interface.

GMI Lab’s projections for next three years are included in this report as well.
The GMI™ Lab

The GMI™ Lab operating from ENG 143 has the following three main components, ordered by space usage as follows:

(a) GMI™ Graduate Teaching and instructional Lab
(b) GMI™ Research Lab
(c) UALR-UCCS CoView Data Lab™
(d) CS-Unix Instructional Lab

CS-Unix Instructional Lab, which occupies estimated thirty-three percent of the space in ENG 143 is maintained directly by CS department and will not be explained in this report. GMI Lab has the rest of sixty-six percent of the ENG 143 as available space to support 26 students and all the eight classes at the senior/graduate level offered over the period of three-year cycle.

Assets of the GMI™ Lab

GMI Lab has a projection system for small device such as phone, Augmented Reality eye-glasses, PHANTOM force feedback device, Dual Core GPU Process, magnetic motion tracker, 8 chamber aroma device, and several PCs, Old SGI system and 1 Mac system. Some of these systems, magnetic trackers and SGI systems are offline at this time due to space limitation and age.

(a) GMI™ Graduate Teaching and Instruction Lab: Intel donation $50,000 (2002)

The GMI Lab directly supports all instructional needs the Masters of Science in Computer Science: Focus GMI Program (MSCS – GMI). The Graphics Lab, operating from ENG 140, and the VR lab, operating from ENG 143, has been in existence in Computer Science department since 1987, and 1991 respectively. These two labs were supporting the instructional need for all courses in the area of graphics and VR within the Computer Science Department and the Masters of Engineering program in Media Convergence, Games and Media Integration (now MSCS – GMI). A grant of $50,000 Intel donation in 2002 upgraded the equipment. In Spring 2011, Dr. Wiener consolidated these two labs in one in ENG 143. With partnership with UALR and support by Dean Dan Dandapani, and Joe Swaty, CoView Data Lab began its work in Summer 2011.

The GMI Lab today directly supports the instruction of the following courses:

- Introduction to Graphics (CS4800/5800);
- Advanced Computer Graphics (CS5810);
- Geometric Modeling (CS5760);
- Computational Geometry (CS5750);
- Animation and Visualization (CS5770);
- HCI and VR (CS6770).
- Wearable computing and complex systems (CS5790)
- 3D Games and Digital Contents Creation (CS5780).
**Design and Analysis of Algorithms (CS4720/5720).**
**All CS 7020 (GMI Portfolio); MS CS Thesis and Projects.**

In 2013, following courses were taught:

CS 5810 Advanced Graphics (7 students); CS 5790 Wearable Computing and Complex Systems (10 students); CS 5770 Animation and Visualization (8 students); CS 4720/5720 Design and Analysis of Algorithms (32 students); CS 4800/5800 Introduction to Graphics (35 students); Computational Geometry (7 students). Total enrollment 99 over six courses with 16 students per class. GMI Lab supported 24 out of 99 students in 2013, and the PhD/MS thesis and portfolios as indicated below.

**PRESS/INTERNET/NEWSPAPER COVERAGE**

-- Crossover Applications Conference, May 14, 2011 Coverage: [https://www.cu.edu/content/semwalteamingtechnologyimproveeducationblind](https://www.cu.edu/content/semwalteamingtechnologyimproveeducationblind)


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CoView Data Labs UCCS Initiative aims to Engineer Funds: November 19, 2011: [http://www.gazette.com/articles/initiative-128785-jobs-colorado.html](http://www.gazette.com/articles/initiative-128785-jobs-colorado.html)

**GMI LAB PARTNERS WITH THEATREWORKSTM EXHIBIT – Inspector General and The Seagull – FIRST TIME COLLABORATION**

March 2011: GMI program portfolio exhibit will start along with the showing of two great Russian plays this spring at Bon Vivant Theater in Colorado Springs, celebratering Maslenitsa, the melting of the snows -- The Inspector General by Nicolai Gogol and The Seagull by Anton Chekhov. The team of -- Nicholas Sterling, Mike Bolei, Professor SK Semwal, Prof Kevin Landis, and Murray Ross -- have been planning it since last semester. The exhibit will be set in the lobby of TheatreWorks, and will use five screens to show the google maps of the series of events in the life of Nicolai Gogol and Anton Chekhov's life. (Semwal’s eMail excerpt).


Dr. Pamela Shockley-Zalabak, UCCS Chancellor opening the first conference in 2010 stated “This is exactly the thing UCCS should be involved.” Since then there have been three such symposiums here at UCCS. EAS Dean Dr. Dandapani was present during the opening ceremony for all three symposiyms. Dr. Tani Anthony, state consultant for the blind/low vision who is an
international expert, followed the Chancellor with her suggestion that a global partnership is necessary. Lou Tutt, Executive Director of AER (Association for Education and Rehabilitation of the Blind and Visually Impaired) who was the Director of Colorado School of the Blind and Visually Impaired until April 2011, suggested that how technology can help the Blind and the visually impaired.

Figure 1: Conference attendees 2010 (left) Right: RonMcEwan (leftmost) with attendees 2012.

Dr. Gary Bishop, Professor, University of North Carolina joined as a keynote speaker. Everyone in the audience felt that his Tarheel reader and his work was amazing. Pedro Milliet followed from Sao Paulo Brazil with an interesting discussion on Braille text books being published by Neville Foundation.

Five tracks were simultaneously presented with volunteers leading a small group of attendees to different tracks. Track 1 was organized by Dr. Thiene and Jim Olson on low vision options. Track 2 was presented by Ron McEwan on Mac VoiceOver keystrokes and iPhone.

Mike Bolei presented haptic game, Keith Johnson presented a virtual environment with aroma, haptics, sound and graphics showing solving 3D matching game. Barbara Traecy presented a haptic memory game and Bonnie Snyder presented her surprise package - mobile phone applications.

During lunch the 2nd GMI Crossover applications awards were awarded. Dr. Richard Doyle and Dr. Trajan Boughan were awarded our first GMI award for his volunteer-work to help a student in one of the mechanical engineering class in Spring 2011.

Nick Sterling and Mike Bolei were the recipients of GMI awards for first GMI movie with TheatreWorks™ which premiered in Spring 2011 at TheatreWork’s Anton Chekov’s Seagull Lands and Nikolai Gogul’s inspector General.
Figure 2: Dr. Richard Doyle (left) and Dr. Baughan (Figure 2 right, third from left) receiving award. Drs. Dandapani and Semwal. Dr. TMike Bolei receives award. Photo Credit: Joe Swaty.

Colarao Department of Education, 3DSoft (David Hollenbach, silver level support), MagniSight, BeyodSight, CSDB, The GMI Program, UCCS, Disability Services Office, UCCS, and Engineering and Applied Science (EAS, gold-level support) UCCS.

Figure 3: 1st GMI Crossover Applications 2010 attendees –May 15, 2010.
GMI LAB PLAN FOR NEXT THREE YEARS: Jan 2014- Dec 2016

1. MANUSCRIPTS under preparation

Following research papers are under preparation and will be submitted for publications

- Dome Displays and Vpresent with Nick Steling, Jonathan Metzgar et al.
- Interactive haptic mesh sculpting with Rudolpho Ortiz
- Memory Games for the Blind with Barbara Tracey
- Modeling Ink flow with Ben Wood
- OpenVGF: An Open Source Video Game Framework with Daron Anderson
- Target Tracking a non-linear path using Kalman predictive Algorithm with Dennis Musick et al
- "haptic objects editing" with Michael Rudolph
- Haptic medical visualization with John Magby, Mike Bolei, Karl Reinig.

2. GMI LAB will engage and create a Enrichment Center (Sunday 10-12noon) every week for the Blind and Visually Impaired community to engage in technology learning with family. One family a week is planned. GMI Lab will support.

3. GMI Lab will continue to support the GMI Consortium (http://www.cs.uccs.edu/~ssemwal/MICL/GMIConsortium_Info.pdf)

4. RESEARCH PARTNERSHIPS TO BE FORMED WITH LOCAL INDUSTRIES

Following are research partnerships which are expected to continue:

a) Touch of Life, interactive medical applications – GMI Lab worked with this company in the past, the company was very impressed by our work and has hired the student (Jon Magby). ToL is interested in funding, need based, research with the GMI lab.
b) DSoft partnered with us in the Department of Ed proposal in 2012. They are our first silver level industry member, and will continue their support.
c) We are developing interaction between GMI Lab and Sanborn, a world leader in mapping technology.
d) High Quality GMI Presents InDepth Lecture Series to return High quality GMI Presents innovative series which is 6-8 week long series on the current topic of the day. These series allow students working in GMI lab to learn new topics in depth and detail which are not covered in the courses. For example, workings of Maya animation package, MEL, Unity 3D and UDK game engines had been the topics in the past (2009-2010). Information on these series is attached with this report as addendum.

5. GMI Lab Instruction and graduate student training
GMI Lab will continue to offer Graduate Instruction and Graduate thesis, project, portfolio, independent studies as outlined earlier.