

VR HARDWARE LAB (ROOM 106)

- **Corner Cave VR System**
 - Custom screen size, 3D glasses
- **3D Wall**
 - WorldViz 3D Wall Touch PRO
- **Head Mounted Display (HMD)**
 - nVisor SX111
 - HTC Vive
 - Samsung GearVR
 - Hollow Lens
 - Z800 Dual Pro Ruggedized
 - Google Glass and Shutter Glasses
 - Oculus Rift Head set + Oculus Touch
 - NVIDIA 3D Vision Glasses Kit
- **VR Gloves**
 - Cyber Glove III, Wireless
 - 5DT Data Glove 5 Ultra, RH
 - 5DT Data Glove 5 Ultra, LH
 - 5DT Data Glove Ultra Wireless Kit
- **Motion Detection**
 - 3D Wall Touch Pro cameras
 - Virtual Cube Head Tracker
 - Microsoft Kinect
 - 5DT Motion Builder Driver
- **3D Gaming Desktops**
 - Alienware Aurora-R4

VR SOFTWARE LAB (ROOM 312)

- **Modeling:** 3D StudioMax, Maya, Soft Image, Mudbox, Motion Builder, Blender.
- **VR Programming:** Vizard 5.0, Virtools 5.0, Unity 3D, VRML pad, Microsoft Visual Studio, OpenGL, ARToolkit, ALVAR libraries.
- **18 Alienware Aurora-R4 3D Gaming Desktops**



GRANTS

- **ARL Grant:** Megacity: Avatars in Collaborative Virtual Environment (CVE) approach for Decision Making, under U.S. Army Research Laboratory (ARL), Award No. 12396753, funded by ARL-HRED division under Assessment and Analysis campaign, Amount: \$85,000.00, Period: 08/4/2017 to 08/3/2018,
- **NSF:** "A Problem-Based Learning Approach to Teach Gaming and Development of Gaming Instructional Modules to Enhance Student Learning in Lower Level Core Courses". NSF-HRD-1238784, Amount: \$299,500, Period: 2012 to 2017.
- **DHS: Department of Homeland Security:** Scientific Leadership Award, "Developing Homeland Security Expertise to Support Emergency Evacuation Research", 2011-ST-062-000050, Award Amount: \$249, 901.29 Award Period 2011 to 2015.
- **NSF:** "Increasing Expertise of Minority Students by Development of a Virtual and Augmented Reality Laboratory for Research and Education at Bowie State University", NSF-HRD-1137541, Award Amount: \$299,489, Period: 2011 to 2014.



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Virtual Reality Laboratory



VR Lab Website

<http://www.cs.bowiestate.edu/sharad/vrlab/>



DR. SHARAD SHARMA

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DEPARTMENT OF COMPUTER SCIENCE

BOWIE STATE UNIVERSITY

ROOM NO : 106 AND 312 CSB

GOAL

The goal of this VR laboratory is to introduce students to Virtual Reality (VR) hardware, software, and provide an opportunity for them to apply this knowledge to applications for education and games. This laboratory applies cutting-edge VR technology currently available in academia and industry. The lab applies research methods from social science, human-computer interaction, and data visualization to address the challenge of including social, emotional, and communication factors into modeling and simulation of crowd behavior.

MISSION

The students and faculty are pioneering the use of VR technology in areas such as evacuation simulation, way finding, navigation, emergency response, Multi User Virtual Environment (MUVE), Augmented Reality (AR) and battlefield simulation.

ACTIVITIES

VR Lab provides students and researchers with high quality 3D gaming workstations, stereoscopic displays, motion trackers, 3D input devices, and force feedback devices.

RESEARCH PROJECTS

Our current research projects mainly focus in the areas of Virtual Reality, Augmented Reality and Software Engineering.

I. VIRTUAL REALITY (VR)

Game-Theme Instructional Modules

The aim of this project is to create game theme based instructional (GTI) modules with more inquiry based problem-solving activities and hand-on experiences based using VR, AR and Gaming.



Multi-User Virtual Environment (MUVE) For Evacuations Drills, Emergency Response and Decision Making

The project proposes an experimental design setup for accessing human behavior in emergency evacuation among a team of players in a game setup. Following are the MUVES designed as a part of our research work.

1. Subway Evacuation

The Subway MUVE allows for large groups of people to participate in virtual evacuation drills at the same time. We have defined rules for computer controlled agents and also providing controls to the user controlled agents to navigate. We used Oculus Rift for performing immersive drills.



2. Airplane Evacuation



Airplane MUVE could be used as an educational and training tool for depicting emergency scenarios. We have conducted user studies (50 sessions) for virtual evacuation drills performed in both immersive (HMD, OCULUS RIFT) and non-immersive (Desktop) environments.

3. Crowd Behavior and Traffic Intersection Problem in a Virtual City

The project aims at developing a crowd behavior capability in a virtual city where there are traffic intersection junctions for people to cross the road.



The MUVE consists of individuals and group behaviors with differing levels of fidelity. Participants enter MUVE as a car avatar where the goal is to safely drive in the city by following traffic laws. We have conducted user studies for the virtual city MUVE in both immersive (HMD) and non-immersive (Desktop) environments.

4. Campus and School Bus Evacuation



Our proposed application shows an immersive collaborative virtual reality environment for performing virtual online campus tours and evacuation drills using oculus rift head mounted displays.

4. Virtual Reality Classroom

This project presents a novel Virtual Environment (VE) which employs a dynamic 3-D model of the classroom. The multiuser aspect has been implemented and tested. In the current system people can navigate the virtual classroom as a student or as an instructor using keyboard inputs. We have used Microsoft Kinect to detect user motion for instructor.



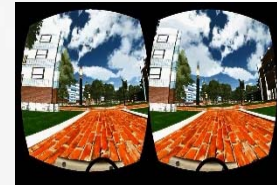
II. AUGMENTED REALITY (AR)

1. Mobile Augmented Reality Application (MARA) for campus navigation



We have developed a MARA using UNITY 3D which will help people to safely evacuate a building in case of an emergency. Our solution includes placing the markers at key spots in the building, such that the user can use their phones to view the 3D representation of the building and exits.

2. Interactive Virtual Tour of Campus



We have created a BSU university campus 3D environment using Unity 3D, Samsung Gear VR and Samsung Galaxy S6.

III. SOFTWARE ENGINEERING (SE)

Modelling evacuation behavior in a multi agent system

We are developing crowd-modeling and emergency behavior modeling capability in a goal finding application using C#.



We are modelling the agent behaviors in two different approaches to reach the exits (goals) during evacuation.

- 1) Combination of combining Genetic Algorithm (GA) with Neural Networks (NN).
- 2) By creating a Fuzzy Rule based System for evacuation behavior.