



Approved in 37th BoA Meeting (29-10-2020)

Course Number : CS662
Course Name : Mobile Virtual Reality and Artificial Intelligence
Credits : 3-0-0-3
Prerequisites : CS 660, CS 669, or an equivalent course in AI/ML area
Intended for : B. Tech./M. Tech./M.S./Ph.D. students

1. Preamble:

The virtual reality (VR) industry is growing rapidly with applications in several domains. VR applications are revolutionizing how human-beings interact with computers and a number of companies in the human-computer interaction area are at the forefront of this technology with VR products. Although VR application development in industry is gaining popularity, finding human resource with VR skills is a challenge. This course addresses this challenge by training interested students in mobile VR application development that involves AI in VR. The primary objectives of this course include the following: To give students hands-on exposure to mobile virtual reality; to give students experience with basic AI in virtual reality; and, to provide students with fundamentals of application design in virtual reality. The course will use tools such as Unity to provide hands on experience to the students and the students will gain exposure to such tools.

2. Course modules with quantitative lecture hours:

Modules

Module 1: Introduction to VR and VR programming

(12 hours)

Introduction to VR and its historical perspective (e.g., Sensorama simulator or Ivan Sutherland's Sword of Damocles), Introduction to software tools for VR: Moving a Cube, Lights, Particle Systems, Applying Physics, and Assets, VR Coding Introduction, Variables, Methods, If Blocks, Loops, Hello Mammoth, User Interaction, Inputs Introduction Preview, Key Presses, Moving a Player, Jumping, Moving Forward, Cycling Cameras, Prefabs Introduction, Instantiating Objects, Random Angles, Destroying Objects, Explosion Effects, Adding Explosion Effects.

Module 2: Building the first AI simulation

(6 hours)

Developing a Pathfinding Game, How to Set Up a Project, Node, String Map, A* Algorithm Setup, A* Algorithm Loop, Auxiliary Methods, Finishing the Algorithm, Importing 2D Assets, Building a Level, From Console to Visual, Adding Tanks, Identifying Nodes, Moving the Tank, Visually Moving Tank, Smooth Movement, Smooth Rotation, Ordering Tank to Move, Speeding up Player, Spawning Logic, Crate Visuals, Adding Crates to Valid Positions, Collecting Crates, Score Counting, Game Interface, Starting the Game, Game Over Screen, Scoring, Sounds.

Module 3: Introduction to Virtual Reality and Blending

(8 hours)

VR Introduction, Camera Changing Position, Triggering Events Interface, Blending and Introduction & Customizing Settings, Controlling Blender Camera, Emulate Numpad Camera, Manipulating Objects, Common Tools, Mirroring 1 Side of Object. Case Study: Flappy bird game in VR, First person shooter VR game, Kart VR game.



Module 4: Introduction to ML in VR

(6 hours)

Introduction to Machine Learning, the need for ML in VR, different kinds of learnings, Neural Networks (NNs), Training a NN, Optimizer, Convolutional layers, Transfer learning, Imitation learning. Case study: Training the kart in kart game via IL and testing the kart drive.

Module 5: Reinforcement Learning

(10 hours)

Introduction to Reinforcement Learning, Initial state, Training a policy, The PPO algorithm, Evolutional Strategies, Reward. Case study: Training a kart in the kart game with RL, Tensorboard analysis, Testing results.

3. Textbook:

Buttfield-Addison, P., Manning, J., Nugent, T. (2019). *Unity Game Development Cookbook: Essentials for Every Game*. O'Reilly Media.

4. Reference books:

Linowes, J., & Schoen, M. (2016). *Cardboard VR Projects for Android*. Packt Publishing Ltd.

Lanham, M. (2019). *Hands-On Deep Learning for Games: Leverage the power of neural networks and reinforcement learning to build intelligent games*. Packt Publishing Ltd.

Aversa, D., Kyaw, A. S., & Peters, C. (2018). *Unity Artificial Intelligence Programming: Add powerful, believable, and fun AI entities in your game with the power of Unity 2018!*. Packt Publishing Ltd.

4. Similarity Content declaration with existing courses:

S.No	Course Code	Similarity Content	Approximate %. Of Content
NA	NA	NA	NA

5. Justification for new course proposal if cumulative similarity content is >30%

N.A.