

UČNI NAČRT PREDMETA / COURSE SYLLABUS						
Predmet:	Razvoj projektov razširjene resničnosti					
Course title:	Extended reality projects development					
Študijski program in stopnja Study programme and level	Študijska smer Study field			Letnik Academic year	Semester Semester	
Razvoj videoiger in razširjenih resničnosti, visokošolski strokovni študijski program prve stopnje	-			Tretji	Peti	
Game and Extended Reality Development, first cycle Professional Study Programme	-			Third	Fifth	
Vrsta predmeta / Course type			Obvezni / Obligatory			
Univerzitetna koda predmeta / University course code:			4-RVRR-VS-RPRR-2025-09-19			
Predavanja Lectures	Seminar Seminar	Vaje Tutorials	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	-	50	-	-	100	6
Nosilec predmeta / Lecturer:			doc. Sagir Nadav			
Jeziki / Languages:	Predavanja / Lectures:		Slovenski, angleški / Slovene, English			
	Vaje / Tutorials:		Slovenski, angleški / Slovene, English			
Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:			Prerequisites:			
Študenti predhodno osvojijo vsebine predmetov 3D modeliranje in 3D animacija likov. Projektna naloga in interaktivni prototip morata biti pozitivno ocenjena.			Students first study the content of the courses in 3D modeling and 3D Character Animation. The projects assignment and the final interactive prototype must be positively evaluated.			
Vsebina: Predmet študente seznanja s teorijo in prakso procesa oblikovanja videoiger in igralnih izkušenj na igralnem pogonu (Unreal Engine / Unity) v realnem času. Predmet je sestavljen iz dveh delov. V prvem, uvodnem delu se študenti			Content (syllabus outline): The course introduces students to the theory and practice of the process of designing games and game experiences on a real-time game engine. The course is divided into two parts.			

seznanijo s teoretičnim in zgodovinskim diskurzom, ki zajema zgodovinski razvoj medija od njegovih začetkov do sodobnih trendov. Študenti se bodo seznanili s primeri videoiger, ki predstavljajo ključne tehnološke, ustvarjalne in žanrske mejnike v razvoju tega medija. Nato se predmet osredotoči na oblikovanje in razvoj dokumenta o zasnovi igre (Game Design Document, v nadaljevanju GDD), temeljnega dokumenta, ki ima osrednjo vlogo pri učinkovitem razvoju videoiger. GDD vsebuje vse tehnične in ustvarjalne informacije, potrebne za izdelavo igre, in se uporablja za vodenje razvojne ekipe ter organizacijo postopka razvoja igre. Ta dokument razvojni ekipi omogoča, da svoje zamisli in zasnovo pretvori v funkcionalno, tržno zanimivo in privlačno igro.

Drugi del se osredotoča na produkcijski proces ali standardne tehnike in vidike produkcije videoiger, kot so prakse oblikovanja ravni na vseh področjih (animacija, osvetlitev, postavitev kamere, razvoj vmesnika) in uvod v vizualni skriptni sistem, ki začetnikom omogoča vstop v logiko razvoja iger. Študenti se bodo metodično seznanili z mehaniko iger, hitrim prototipiranjem in agilnim razvojem iger, testiranjem iger in iterativnim oblikovanjem, osredotočenim na uporabnika, ter s tem, kako oceniti proces oblikovanja. Celoten drugi del poganja Unreal Engine/Unity pogon, ki je temelj razvoja interaktivnih 3D iger, ki omogoča naraven prehod v razširjeno resničnost in ustvarjalcem iz različnih panog omogoča zagotavljanje interaktivnih izkušenj in vizualne poglobljenosti.

Prehod iz resničnega sveta v povsem imerzivno okolje je pogojen s tehničnimi zahtevami in pripomočki (kot so slušalke ali očala za virtualno resničnost, haptične rokavice itd.), tako da so študenti pri laboratorijskih vajah že večji uporabe opreme za razširjeno resničnost ter razumejo njene značilnosti in morebitne omejitve.

Čeprav je poudarek predmeta na oblikovanju videoiger v razširjeni resničnosti, bo predmet študentom omogočil skupno razumevanje vala novih sodobnih

In the first, introductory part, students will be introduced to the theoretical and historical discourse covering the historical development of virtual and augmented media from its beginnings to contemporary trends. Students will be introduced to examples of video games that represent key technological, creative and genre milestones in the development of the medium. The course then focuses on the design and development of the Game Design Document (GDD), a fundamental document that plays a central role in the effective development of video games. The GDD contains all the technical and creative information needed to produce a game and is used to guide the development team and organise the game development process. This document enables the development team to translate their ideas and design into a functional, commercially interesting and engaging game.

The second part focuses on the production process or standard techniques and aspects of video game production, such as level design practices in all areas (animation, lighting, camera placement, interface development) and an introduction to the visual scripting system, which allows beginners to enter the logic of game development. Students will be methodically introduced to game mechanics, rapid prototyping and agile game development, game testing and iterative user-centred design, and how to evaluate the design process. The entire second session is powered by the Unreal Engine/Unity, the foundation of interactive 3D game development, which provides a natural transition to extended reality (XR) and enables creators from a variety of industries to deliver interactive experiences and visual immersion.

The transition from the real world to a purely immerse environment is conditioned by technical requirements and accessories (such as virtual reality headsets or goggles, haptic gloves, etc.) so that in the laboratory exercises students are already proficient in

produksijskih oblik in metodologij, ki z uporabo Unreal Engine/Unity v realnem času spreminjajo obraz medijske in zabavne industrije.

Teme:

1. DEL

- Zgodovinski razvoj iger razširjene resničnosti in razumevanje njihovega vpliva na različnih področjih,
- Uvod v ustvarjanje vsebine iger
- Potek ustvarjanja iger, od zasnove, izvedbe in testiranja
- Razvoj in struktura dokumentacije
- Temeljni dokument o zasnovi igre; funkcija, pravila, struktura, cilj
- Igralna mehanika (količina, prostor, stanje in delovanje)
- Oblikovanje ravni: Pretok in mehanika

2. DEL

- Namestitev Unreal Engine/Unity pogona in ustvarjanje novega projekta
- Pregled Unreal Engine/Unity pogona: Uvod in uporaba urejevalnika Unreal Editor/Unity: navigacija, izbirni načini, vsebinski brskalniki, paneli, itd.
- Pozicioniranje in preoblikovanje različnih »akterjev« (kamera, statični mrežni objekti ali začetna lokacija igralca)
- Gradnja igralnega okolja
- Ustvarjanje in apliciranje senčil in materialov s pomočjo urejevalnika materialov
- Osvetlitev »sveta«
- Postavitev in vključevanje 3D animacije likov
- Osnove interaktivnega zvočnega sistema v pogonu Unreal Engine/Unity
- Dodajanje in oblikovanje zvokov in zvočnih učinkov
- Uvod v fiziko in sile za simulacijo
- Osnovni pregled sistema delcev
- Osnovna orodja in principi vizualnih učinkov
- Blueprint: vizualno skriptiranje
- Dobre prakse pri oblikovanju iger

the use of extended reality equipment and understand its characteristics and possible limitations.

Although the focus of the course is on the design of video games in extended virtual reality, the course will provide students with a shared understanding of the wave of new contemporary production forms of creative tools and methodologies that are changing the face of the media and entertainment industry in real time using the Unreal Engine/Unity.

Topics:

1. PART

- The historical development of extended reality games and an understanding of their impact in various fields,
- Introduction to Game Content Creation
- Game creation pipeline, from design, implementation and testing
- Documentation development and structure
- Fundamental Game Design Document; function, rules, structure, aim
- Game mechanics (quantity, spatial, state, and action)
- Level Design: Flow & Mechanics

2. PART

- Installing the Unreal Engine/Unity engine and creating a new project
- Unreal Engine/Unity overview: Introduction and use of the Unreal Editor/Unity: navigation, selection modes, content browsers, panels, etc.
- Positioning and reshaping of various "actors" (camera, static mesh objects or starting location of the player)
- Building a gaming environment
- Creating and applying shaders and materials using the material editor
- Illumination of the "world"
- Layout and inclusion of 3D animation of characters
- Basics of Unreal Engine/Unity interactive sound system
- Adding and designing sounds and sound effects

<ul style="list-style-type: none"> • Kako nastaviti optimalne parametre razširjene resničnosti v pogonu Unreal Engine/Unity <p>OPOMBE: Vaje pri predmetu se izvajajo z uporabo očal za navidezno resničnost (VR) in razširjeno resničnost (AR) ter pripadajoče opreme, prilagojene specifičnim potrebam posameznih vaj.</p>	<ul style="list-style-type: none"> • Introduction to physics and forces for simulation • Basic overview of the particle system • Basic tools and principles of visual effects • Blueprint: visual scripting • Good practices in game design • How to set the appropriate parameters for Extended Reality in Unreal Engine/Unity <p>NOTE: The practical exercises for the course are conducted using virtual reality (VR) and augmented reality (AR) headsets along with accompanying equipment, tailored to the specific requirements of each exercise.</p>
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Temeljni literatura in viri / Readings:

- Borromeo, N., A., (2022). Hands-On Unity 2022 Game Development: Learn to use the latest Unity 2022 features to create your first video game in the simplest way possible, Packt Publishing
- Patrick, F. (2019).Unity From Zero to Proficiency (Beginner): Learn C# Programming from Scratch by Creating an Adventure Video Game with Unity: Enhance Your Coding Skills Easily and Enjoy the Learning Process, Independently published

Cilji in kompetence:

Cilji:
Po zaključku predmeta bodo študenti razumeli osnove pogona Unreal Engine/Unity z ustvarjanjem lastnega interaktivnega fotorealističnega okolja od začetka do konca. Tekoče bodo krmarili v pogonu Unreal Engine/Unity in uporabili ključne koncepte v svojih prihodnjih projektih.

Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc:

Splošne kompetence:

- Usposobljenost za izvajanje vseh faz razvoja programskih rešitev: načrtovanje, razvoj, testiranje, implementacija in vzdrževanje.
- Prepoznavanje in ocenitev aktualnih in nastajajočih tehnologij in sodobnih metod, veščin in tehnik s področij videoiger in razširjenih resničnosti ter ocenitev njihove

Objectives and competences:

Aims:
Upon completing this course, students will have learned the fundamentals of the Unreal Engine/Unity by creating their own interactive photo-realistic environment from start to finish. They will get comfortable navigating the Unreal Engine/Unity and apply key concepts to their future projects.

The instructional unit contributes to the development of the following general and subject-specific competences:

General competences:

- Ability to perform all phases of software development: design, development, testing, implementation and maintenance.
- Identification and evaluation of current and emerging technologies and contemporary methods, skills and techniques in the fields of video games and extended reality, and

uporabnosti za reševanje potreb uporabnikov.

- Sposobnost učinkovitega ustvarjanja projektne dokumentacije, shem, diagramov poteka in oblikovnih rešitev, primernih za razvoj in produkcijo videoiger in razširjenih resničnosti.
- Sposobnost samostojnega sledenja najnovejšim tehnološkim dosežkom in pridobivanja novih znanj, ki so uporabna v produkciji videoiger in razširjenih resničnosti.
- Usposobljenost za skupinsko delo v vseh fazah razvoja in oblikovanja programske opreme.
- Upoštevanje etičnih načel v produkciji videoiger in razširjenih resničnosti.

Predmetno-specifične kompetence:

- Poznavanje zgodovine videoiger in ključnih del na nastajajočem področju razširjene resničnosti;
- Ustvarjanje programske dokumentacije za reševanje tehničnih in oblikovalskih problemov v procesu oblikovanja iger (GDD) in razširjenih resničnosti;
- Izbira in uporaba ustreznih metod in tehnik v različnih fazah razvojnega cikla videoigre;
- Poznavanje različnih praktičnih spretnosti, vključno z osnovnim poznavanjem Unreal Engine/Unity kot pogona za ustvarjanje interaktivnih projektov v razširjeni resničnosti;
- Poznavanje temeljnih načel oblikovanja in programskih orodij za ustvarjanje 3D igralnih izkušenj z uporabo različnih vmesniških naprav za razširjeno resničnost (VR naglavnih slušalk in očal, VR haptičnih rokavic itd.);
- Sposobnost ustvarjanja, testiranja in preoblikovanja interaktivnega prototipa na pogonu Unreal Engine/Unity;
- Veščine za uporabo nastajajočih tehnologij razširjene resničnosti ne le

assessment of their applicability to address user needs.

- Ability to effectively produce project documentation, flowcharts, diagrams and design solutions suitable for the development and production of video games and extended reality.
- Ability to independently keep up to date with the latest technological developments and gain new skills useful in video game and extended reality production.
- Ability to work as part of a team in all phases of software development and design.
- Adherence to ethical principles in the production of video games and augmented reality.

Subject-specific competencies:

- Knowledge of the video games history and key works in the emerging field of extended reality;
- Creating software documentation to solve technical and design problems in the game and extended reality design process;
- Selection and application of appropriate methods and techniques at different stages of video games development cycle;
- Knowledge of a variety of practical proficiencies including basic knowledge of Unreal Engine/Unity as a software tool to create extended reality;
- Knowledge of the fundamental design principles and software tools to produce expressive 3D game experiences using a variety of extended reality interface devices. (VR Headset, VR Gloves, etc.);
- The ability to create, test and redesign an interactive prototype on Unreal Engine/Unity;
- Skills to use emerging extended reality technologies not only as tools for video games, but as tools for many industries.

kot orodij za videoigre, temveč kot orodij v številnih panogah.

Predvideni študijski rezultati:

Znanje in razumevanje

Študent / študentka:

- je sposoben strukturirati in voditi projekt oblikovanja igre od zamisli do igralnega prototipa.
- Ve, kako ustvariti igralna okolja (igralne ravni in cone) v Unreal Engine/Unity pogonu.
- ima izkušnje z ustvarjanjem okolij v Unreal Engine /Unity pogonu.
- Ve, kako ustvariti interaktivno okolje z uporabo ključnih protokolov in elementov grafičnega uporabniškega vmesnika za razširjeno resničnost.
- razume urejevalnik materialov in osnovna načela ustvarjanja materialov za fizično zasnovano upodabljanje (PBR) v Unreal Engine/Unity pogonu.
- Ve, kako v programu Unreal Engine/Unity pogonu nastaviti prizor za realistično notranjo in zunanjo osvetlitev, osvetlitev lika ali nočno osvetlitev.
- ima osnovno razumevanje konceptov in tehnik pisanja skripta v Unreal Engine/Unity pogonu.
- zna simulirati fiziko in zaznavati trke v Unreal Engine/Unity pogonu
- razume zvočni sistem v pogonu Unreal Engine/Unity zna ustvariti in izvažati videoigre v opremo za navidezno resničnost Oculus Rift/MetaQuest 3 (ali podobno)
- razume, kako je mogoče oblikovanje videoiger uporabiti v akademskem procesu ustvarjanja novega znanja.
- razpravlja o razvijajočih se tehnologijah in inovativnih pristopih k razširjeni resničnosti, ki jih

Intended learning outcomes:

Knowledge and understanding

The student:

- can structure and manage a game design project from concept to playable prototype.
- knows how to create a game environment creation (game levels and zones) in Unreal Engine/Unity.
- has experience in creating environments in Unreal engine/Unity.
- knows how to create an interactive environment using the key protocols and elements of the graphical user interface for XR.
- understand the material editor and basic Physics-Based Rendering (PBR) material creation principles in Unreal Engine/Unity.
- knows how to set up a scene in Unreal Engine/Unity for realistic indoor, outdoor, character or night lighting.
- understands basic scripting concepts and techniques in Unreal Engine/Unity.
- knows how to simulate physics and detect collision in Unreal Engine/Unity
- understands Unreal Engine's/Unity's audio system.
- knows how to create and export video games to Oculus Rift/MetaQuest 3 (or similar) virtual reality equipment.
- understands how video game design can be applied to the academic process of the generation of new knowledge.
- discusses the evolving technologies and innovative approaches to XR used by professionals working across different fields.

uporabljajo strokovnjaki na različnih področjih.	
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Metode poučevanja in učenja:

Predmet je organiziran kot kombinacija predavanj, vaj, samostojnega učenja in mentorstva. Poučevanje na skupnih predavanjih in posameznih individualnih nalogah. Študenti bodo v majhnih skupinah sodelovali pri skupnih projektih s tehnologijo razširjenih resničnosti.

Learning and teaching methods:

The lectures are structured as a combination of lectures, practical exercises, weekly projects, self-study and supervision. Teaching in group sessions and individual assignments. Students will work in small teams on collaborative projects with the XR technology.

Načini ocenjevanja:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

- vaje
- timski projekti
- predstavitev interaktivnega prototipa vključno z celostnim dokumentom igre

Delež (v %) /
Weight (in %)

- 25 %
- 10 %
- 65 %

Assessment:

Type (examination, oral, coursework, project):

- exercises
- collaborative projects
- interactive prototype presentation with Game Design Document

Reference nosilca / Lecturer's references:

Strokovne izkušnje:

2006–danes: Soustanovitelj, CEO in Kreativni direktor Direktor, CtrlArt Llc, Ljubljana, Slovenia (3D animacijski studio, 3D vizualizacije)

2018–danes: direktor Cardotour Animation Mentor - SAE Institute Ljubljana

2014–2016: soustanovitelj, direktor marketinga in financ, Revolv-AR, Izrael

Ekshibicije / projekcije

2021; Grad Škofja Loka, redna razstava

2021; Grad Visoko; projekcija Cveti v Jeseni

2022–2023: The Annunciation of St. Mary - Bazilika Brezje Slovenija - Holographic display <https://www.ctrlart.com/annunciation-of-mary---basilica-of-the-virgin-mary-brezje.html>

2015: Slovenski etnografski muzej dostopen za vse »Dostopnost« <https://www.ctrlart.com/slovene-ethnographic-museum-accessible-for-all---dostopnost.html>

2014; ELLE Style Awards (Renault AR event presentation of new model Twingo); vodja projekta;

2012; i-Emona Exhibition and Film; <https://www.ctrlart.com/3d-model-of-1st-century-roman-city---emona.html>;

2008; MGML Ljubljana, redna razstava portret

Auserperg 2004; Maribor, Utripajoča Škatla, Video Art ekshibicija

Razvoj aplikacij

2022; Aplikacija Crime Door - Alexander Hamilton and Aaron Burr Duel (ZDA); vodja projekta; <https://www.ctrlart.com/crimedoor---hamilton-burr-duel.html>

2021; Aplikacija TravelAR Slovenija – Ptuj; vodja projekta; <https://www.ctrlart.com/travelar-ptuj.html>

2021; Aplikacija Kurentova Simfonija; <https://www.ctrlart.com/kurentovanje-simfonija.html>

2019–2021; Aplikacija CardoTour Jerusalem AR (Izrael); vodja projekta; <https://cardotour.com/>; <https://www.ctrlart.com/cardotour.html>

2020–2023; DI-Gozd forestry inventory technology application; <https://di-gozd.si/>; <https://www.ctrlart.com/di-gozd.html>

2016 – danes; Interaktivna aplikacija in delavnice TravelAR Slovenia; <https://www.travelarslovenia.com>; <https://www.ctrlart.com/travelarslovenia.html> 2016;

Gorenje 'Life Simplified' AR application (Nemčija); vodja projekta; <https://www.ctrlart.com/lifesimplified.html>

2015; Multiplayer AR game 'Akes, finding the right one' for Abanka. <https://www.ctrlart.com/abanka---akescaron--finding-the-right-one.html>

Razvoj platforme

2019–2021; platforma WErPix (Izrael); <https://www.ctrlart.com/werpix--augmented-reality-platform.html>

Delavnice:

Crafty Builders Workshops/Creator Workshops za odrasle; <http://www.craftybuilders.com/>

Članek:

- Aldouby, H., Hasler, B. S., Nadav, T., & Friedman, D. (2022). Viewing images of jagged texture in digital artwork affects body sensations: A virtual reality study. Psychology of Aesthetics, Creativity, and the Arts. Advance online publication. <https://doi.org/10.1037/aca0000522> B.