Chapter 1
Advances in Smart, Multimedia and Computer Gaming Technologies

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Abstract The chapter summarizes the contents of this book highlighting recent advances in smart systems, multimedia, and serious gaming technologies through a fusion of these approaches. Such fusion is a nascent area that potentially can hybridize the features and advantages of the relevant areas, and, as a result, provide users with advanced and enhanced functionality and features, which currently does not exist.

Keywords Fusion technologies · Smart systems · Gamification · Serious games · Fuzzy logic evaluation · Learning activities · Scenario development environment

1.1 Introduction

During the last decade, there has been a huge growth in the area of computer-based training systems, which provide a fusion of smart, multimedia, and serious gaming technologies in various scopes including education, industry, business, health, and tourism. Such systems employ recent advances in virtual reality techniques to create

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D. Sharma et al. (eds.), *Fusion of Smart, Multimedia and Computer Gaming Technologies*, Intelligent Systems Reference Library 84, DOI 10.1007/978-3-319-14645-4_1

3D virtual environments with avatars, which increase the usability of these projects significantly. Serious gaming platforms combine methods and concepts of game technology (computer graphics, multimedia, 3D virtual reality, etc.) with sciences (computer science—information and communication technologies, design, psychology, pedagogy, etc.) in "serious fields of applications" such as designing and educational processes, assessment processes for extreme situations, data driven pattern extraction and predictive modeling in health among others. The goal of these investigations is to implement smart, multimedia, and gaming possibilities as challenges in research, investigation of internet of things as an environment for modeling and creation of services, development of human centered services through data analytics and avatar modeling, and creation of prototypes for commercial products.

1.2 Scope of the Book

The main purpose of this book is to present research results on recent advances in smart, multimedia and computer gaming technologies and it includes seven chapters.

Chapter 2 introduces the main terms in serious games. The term "gamification" means the implementation and active use of computer game design concepts, game thinking, game mechanics, game analytics and computer game technology in business models, core activities, processes, procedures, services, products, etc. to improve user skills, experience, engagement, effectiveness, and productivity outside the pure entertainment area [1]. The performed analysis of multiple additional publications relevant to research, description of pilot systems and applications, current use and future trends of smart technology/systems in industry and businesses clearly shows that smart gamification will be an important research topic in the imminent future and in the following 5–10 years it will be adopted by society [2, 3]. These are the main reasons that it is necessary to understand now this emerging technology, classify its main components and underlying technologies, features and attributes, and formulate requirements to produce well-skilled developers of smart gamified applications and serious games. The reader can find multiple Tables with key factors, references, smart entities, etc. in smart school, smart material, smart home technologies, and industrial applications [4, 5].

Chapter 3 discusses the main concepts of advanced Web-Based Rich Multi-Media (WBRMM) systems incorporating the active use of mobile devices, technology and Web, and multiple types of the Rich MultiMedia (RMM) such as static text, dynamic textual communications technologies [6, 7]. The Virtual Private Network (VPN) technology proved to be one of the most reliable technologies to provide data protection, confidentiality, integrity, data origin authentication, replay protection and access control in mobile computing. This chapter presents the outcomes of a multi-aspect research project aimed to design and develop IPsec VPN-based highly effective (in terms of both security and performance)

communications in the WBRMM systems, including conceptual, design, architectural, and performance-security-cost modeling of those systems [8, 9]. Various popular encryption standards and protocols are considered.

Chapter 4 studies a methodology for augmented teaching and promoting smart Internet of Things (IoT) solutions. The distinctive feature of the proposed approach is that the simulated situation is notably close to that found in reality. The IoT domain model is based on such assertions as: "Physical objects are integrated to the network over the internet", "Physical objects are active participants in business processes", and "In the usage of these objects, the privacy and security issues are highly valued" [10, 11]. The smart-solution concept is notably important in the context of this chapter. The stimuli are obtained from the environment using different sensors and make a response using the knowledge and the actuators that are connected to the system [12]. The other important feature of the presented approach is the model-driven IoT development method [13, 14]. The goal model, decision model, process model, data model, user interface model, and integration model define the solution, and the user can strictly begin to test the application. All the presented solutions are usable on mobile devices.

Chapter 5 provides a conceptual model based on Fuzzy Logic Evaluation Subsystems (FLESs) to implement a "Theory of probability" curriculum. The customized sub-system is used to dynamically evaluate student knowledge [15]. The FLES is designed to gain the students attention, highlights the lesson objective(s), stimulates recall of prior knowledge, and progressively elicits new material to guide increased performance by providing feedback using benign assessment to enhance retention [16, 17]. The proposed system implements three interfacing strategies based on fuzzy logic such as task selection, evaluation, and prompts to help students acquire knowledge. The strategy of tasks selection involves creation of tasks sequence, assignment of complexity level of current task, and definition of numbers of tasks. The teacher makes a decision on relevance of task selection in a current topic, course module, or the whole course. A set of designed fuzzy rules reflect the methodology, which is used by the teacher. The proposed evaluation system is designed as a functioning plug-into the universities "Moodle" server to leverage from the existing course management, learning management and a virtual learning environment.

Chapter 6 presents Innovative Technologies for an Engaging Classroom (iTEC), which provides software tools to design and build scalable learning and teaching scenarios as realistic visions for the future classroom [18, 19]. Eduteka is a toolkit of technologies for advanced learning activity design, components of which provide support for the iTEC pedagogical approach. The Composer tool helps teachers to find, create, and adapt learning activities and share them within their community. The Widget Store can be integrated into the Composer or be used as an independent tool [20]. It allows teachers to search the store themselves and find popular widgets [21]. The Persons and Events Directory as an additional useful tool allows the registered users to find other persons that can contribute to a learning activity or to detect events of interest to a teacher or students in their learning activity. The approach is based on the Scenario Development Environment (SDE) and makes

personalized for each user recommendations. The User Management and Access Control (UMAC) framework integrates protocols into the iTEC environment.

Chapter 7 investigates the issues of 3D Virtual World (VW) technology, which improves user experience and enables new application domains [22, 23]. The 3D VW "vAcademia" has been used as a platform for experimental design, implementation, and evaluation of student knowledge [24]. The chapter presents designed tools for collaborative work, for example, an interactive virtual whiteboard as the main tool in graphical content of the "vAcademia". The capturing of real-life activities with motion tracking for implementation in 3D VW is one of interesting decision of this project. Also many other computer vision technologies are involved including Kinect and iPad for controlling virtual whiteboards, gesture recognition, etc. Finally, three scenarios are considered such as annual shareholder meeting, working with customers, and working in distributed teams that opens new possibilities of the designed project.

Chapter 8 describes new approaches in audioguides systems based on fusion of multimedia and mobile technology [25–27]. One type of original software tool is based on Bluetooth connection to a server is and suitable for small painting exhibitions. The authors believe that using visitors' smartphone is a good way to reduce investments and maintenance costs. The other type of applications is dedicated to a large exhibition and uses a database with stored and edited content, when visitors have get access to information through a content generator. The last one was tested in cooperation with Océanopolis [28], a scientific Marine Park. The proposed model is based on domain ontologies that can enhance the informational potential of objects in a museum catalogue. The chapter includes detailed description of software/hardware tools, many informative schemas, and screenshots of designed client-server application.

1.3 Conclusion

This introduction has provided a brief description of seven chapters comprising this book focusing on a narrative on innovative educational, industrial, and business technologies and their hybridization in solving complex, real world research and service-oriented solutions. All the included chapters explore the recent achievements in smart gamification and serious games, advanced Web-based rich multimedia systems, augmented teaching and promoting the smart internet of things solutions, a fuzzy logic evaluation sub-system used to dynamically evaluate of student knowledge, the innovative technologies for an engaging classroom (iTEC Eduteka) for scalable learning and teaching scenarios as realistic visions, 3D virtual worlds for serious applications, and multimedia/mobile technologies in audioguides systems implemented as museums and exhibitions applications. Each chapter of the book includes results of software/hardware design and provides rich URL resources and indications of future developments. This compilation of advancement in the

theme areas provides a rich set of resources for future work, and we expect to continue developing this resource through future publications of original contributions through this series.

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