Mobile educational game: adventure anywhere

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ABSTRACT
Main topic of this work is development of educational games that can be used on mobile devices. Paper describes a novel approach to educational game defining and interpretation. Idea is based on extracting knowledge, game rules and scenarios outside the program thus enabling reusability. On the other hand by applying a layered approach to educational game interpretation we enable use of the same educational game on different devices and platforms. Purpose of this is to take learning outside classrooms and homes and provide a fun and interesting way of learning anytime, anywhere. Paper shows an example adventure game that is created following this methodology.

Keywords
Educational games, m-learning, mobile devices

1. INTRODUCTION
Mobile devices provide us with the great opportunity to engage students in learning outside classrooms and comfort of their home. This is especially important for students that usually spend a lot of time in transport with a certain amount of free time. Also their natural tendency toward using mobile technologies provides a great base for this approach. The prime assumption of this work is that it is possible to bring process of learning and game-play and exchanging of knowledge to mobile devices, while saving or even improving the usability of such systems in compare to standard use via desktop computer. The challenges of proving such assumptions lie in limited performances regarding mobile devices such as small screen size, limited processing power, reduced input capabilities.

In our work we concentrated on Adventure game genre. Adventure is most used game genre for educational games, since it's more narrative and oriented to problem-solving skills, which are highly appreciated by educators. It can be applied on almost every domain. Enable controlled learning path and knowledge assessment path. In our system, knowledge is integrated into adventure game, received in controlled manner during interaction with NPCs. Educational games that are created using traditional methods provide us with many issues. First issue is inadequate approach to educational game development. In order to get a quality game representation, there must be a strong bond between the environment and the knowledge inserted. Due to the construction process, that bond is usually created during the programming steps. The process of game creation required collaboration between the game designer and the knowledge expert (see Figure 1). Communication between these two participants is often brought to a halt because of misunderstandings, differences in goals and interests etc. The game designer needed programming as well as designing skills. The result of this collaboration is a game that carries certain knowledge and has one form of presentation. The game environment, game context nor the knowledge can be reused.

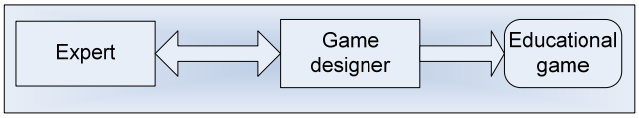

Figure 1. Communication process in educational game development.

Second issue rises from the fact that educational games that are created this way are usualy platform specific. They lack the ability to adapt to a specific device. Standard approach to development of educational games does not take in to account transferability beetween devices. Usually games are built either for desktop or for mobile devices.

2. PROPOSED SOLUTION
In order to apply all the principles identified, the first step was to separate the process of knowledge creation from the process of creating game environment and game context. We achieved that by creating two separate software modules, thus gaining the ability to resolve the communication conflict between the game designer and the knowledge expert (Figure 2).

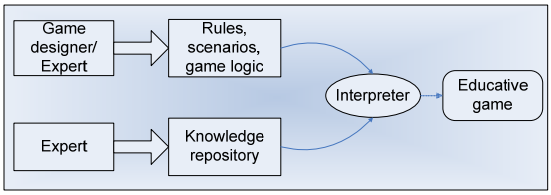

Figure 2. Modular approach to game defining.

A result of creating environment and game context is a unique form of game definition represented as a specifically structured XML document [1]. Game defining is done by the use of the graphical editor that we developed in Java. Graphical components are stored separately but XML document references them within.

The next step is to create a game engine that will present the game based on the created XML document. We created the game structure that allows us to adapt the game to different devices. We

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can divide this structure into several layers (see Figure 3.). Since the game logic as well as knowledge is outside the game code we can build a separate layer that will be able to create a game scene based on the user actions. That particular layer's purpose is to know the specific game type structure and rules of play. Top layer, that is in charge of presentation, has the assignment of reacting to players actions and rising the events to pass towards the game logic. Advantage of extracting the knowledge and game logic outside the program structure enables us to create a middle layer that will provide the service of adapting the content to a specific device.

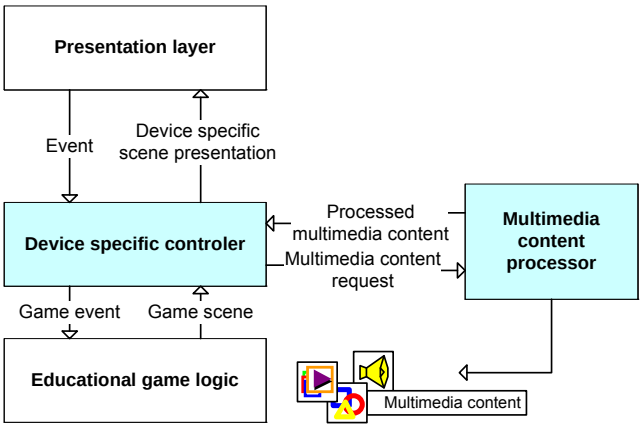

Figure 3. Layered approach to educational game interpretation.

Architecture described exploits the upsides of modularity. By changing the middle layer or by broadening it, we can interpret the same educational game on different devices. When a player raises an event, presentation layer will pass it down towards device specific controller. Since that layer knows the specifics of the device input capabilities it will be able to translate it in to adequate game event. A set of game events can be defined previously. Based on the game event game logic creates a scene that is the result of the game event and passes it back. Device specific controller translates the game scene to a form that is the most acceptable for a given device. For that purpose it is necessary to use the help of some multimedia processing service (see Figure 3.). When a certain game scene is required, device specific controller uses the service of processing the multimedia content. If it is a default device such as a desktop computer, content will be returned unchanged. If it is a device with limited screen, images will be scaled, reduced in color etc. When device specific controller makes a request for multimedia content it provides the information about the specific needs. If images are in question it provides needed resolution, color etc.

We will explain the described architecture on an Adventure game type. It is a 2D game that requires the player to solve specific quests by moving through the game environment, communicating to NPC's (Non Playing Characters) and solving problems.

Figure 4. Scene comparison for different devices.

Same scene can be presented differently based on platform limitation (see Figure 4.). First image shows a scene of starting a new mission in a game run on applet technology. Second image illustrates the exact same scene but run on mobile device emulator (J2ME technology). Second situation takes in to account limited screen as well as limited input methods, so it configures the scene differently. It abstracts the essential for the given scene and presents it to the player.

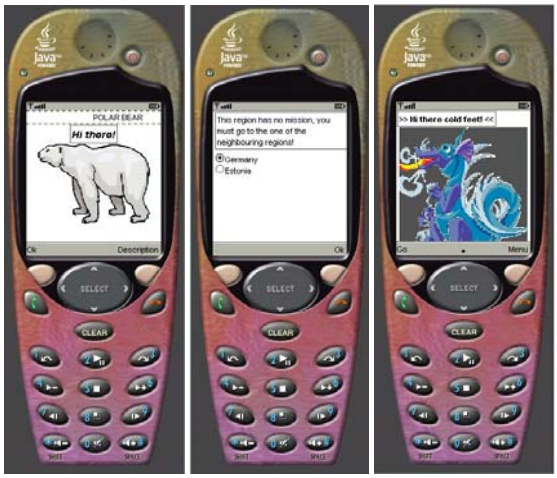

Figure 5. Gameplay on mobile device.

Also it is important to state that the specific way of conducting a game varies dependent on device limitations. Since the background map is rather large it can't be presented evenly on mobile device as well as desktop computer applet technology for example. That is why different resources must be used for different devices. Since there is no ability to display background map on mobile device, player must get a sense of location differently. He must be guided by sufficient amount of text, and NPC images to get a good perspective (see Figure 5.).

3. REFERENCES

[1] Minović M., Milovanović M., Lazović M., Starčević D., 2008. XML Application For Educative Games, Proceedings of European Conference on Games Based Learning ECGBL 08, Barcelona, Spain, 307-31