Backseat Playgrounds: Pervasive Storytelling in Vast Location Based Games

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Abstract. We have implemented a conceptual software framework and a story-based game that facilitates generation of rich and vivid narratives in vast geographical areas. An important design challenge in the emergent research area of pervasive gaming is to provide believable environments where game content is matched to the landscape in an evocative and persuasive way. More specifically, our game is designed to generate such an environment tailored to a journey as experienced from the backseat of a car. Therefore, it continuously references common geographical objects, such as houses, forests and churches, in the vicinity within the story; it provides a sequential narrative that fit with the drive; it works over vast areas, and it is possible to interact with the game while looking out of the windows.

1 Introduction

In recent years location based experiences and location based pervasive games, where a user's bodily and spatial movement in the physical world is a key element, has increasingly become a research focus. However available applications depend on either constant manual work to make the game fit into new geographical areas [5], [8], [10], [12], or lack location based experience beyond navigation support for chasing [2], [6], [9]. We argue that there is an issue of generating content if pervasive and location based games will scale up beyond the limited experimental setups, which has dominated research so far.

In this paper we investigate enriching pervasive games by providing more narrated elements in the game, as well as scale the game environment through integration with increasingly available geographical information systems. Recent advancements within interactive storytelling are promising [1], [3] [7], [11], [13]. First, these engines can extend the scope of pervasive games, beyond simple chasing games, with more complex interaction. Second, these engines could possibly handle the interaction as it occurs through the players movements through the landscape, as an addition to the more active choices pursued within the narrative experience. Furthermore, GIS data is becoming more widely available and accurate. Available map objects can be used for

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reasons other than supporting navigation. They can be used to link the pervasive narrative game with the surrounding environment.

The prototype is designed to provide what we refer to as a "believable environment." In particular we suggest four design characteristics to provide a persuasive inclusion of a journey [4] into a story based pervasive game. First, the story should refer to geographical objects with their everyday meaning. Second, the game needs to scale over vast areas. Third, the application should provide sequential storytelling to make it fit with the journey experience, and finally it should provide interaction support where players can engage in game play and interact with the narrative in various ways at the same time as they are looking out of the car window. In the following, we describe how these requirements have been implemented in the prototype.

2 The System

We have implemented a narrative based game, called Backseat Playground on a platform consisting of a PDA; a gyro and a GPS receiver, and a server running on a lap top which connects to the game device over WiFI. The player acts as a manager for field agents. The technologies are utilized to unfold a crime story with supernatural twists, where the actual location of the car is of importance. The game characters reference geographical objects in the vicinity and the player investigates what is happening with the directional microphone and interact with other characters over the phone or the walkie-talkie.

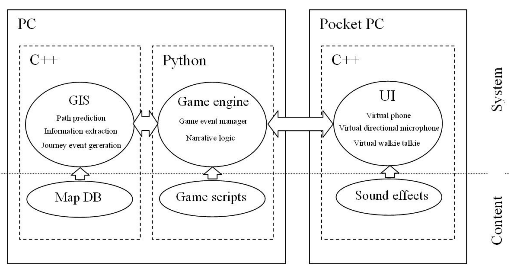

Fig. 1. System architecture

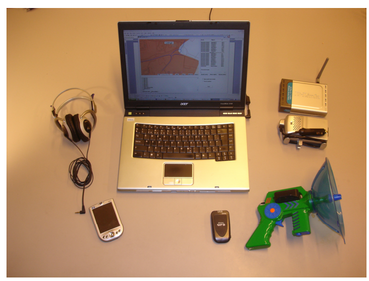

Fig. 2. Hardware

2.1 User Interaction

The user interaction is built around the idea of having a set of virtual devices, i.e. a mobile cell phone, a walkie talkie and a directional microphone. The cell phone and walkie-talkie both provides a means for the players to keep in contact with the game characters. Both devices use text to speech synthesizing with a number of voices, together with a sound effect system to generate natural incoming phone calls and walkie-talkie calls. The virtual user interface of each of the device is displayed on the pocket pc when the device is active. After a call an options menu can be displayed in order to let the user select between different action in response to the call.

The virtual directional microphone enables us to give the sound an actual location. The player tunes into sounds at different virtual locations by turning the microphone around. The direction of the sound is based on data from the direction sensors together with the GPS location. By monitoring the players' use of the microphone the system will be able to determine which of the sounds the player is listening in to. It generally plays sound effects with local reference, e.g. birds, although it is sometimes used together with the text to speech system to let players listen into conversations.

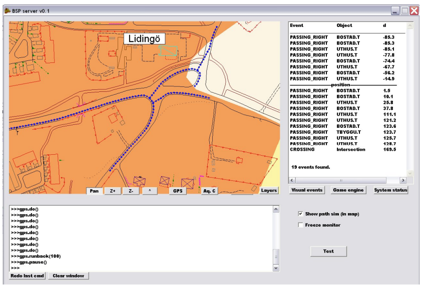

Fig. 3. Server path prediction and journey events

Fig. 4. Children testing prototype

2.2 Game Scripts, Narrative Logic and Game Event Manager

The narrative logic is implemented as a set of story scripts, which each contain a separate part relating to the story world. Each story script contains a tree like structure. The actual path through the tree, i.e. the plot, depends on the player's movements and choices. The narrative logic further ascertains a well paced unfolding of the plot. For example, it keeps track of the tempo between events in the scripts.

The game event manager handles the progression of the game and makes sure different parts of the story are triggered to ensure a meaningful unfolding, as well as an interesting pacing of the narrative. The game event manager first receives a list of roadside objects from the GIS module (see section below) and then asks each story script to rate their current priority to execute according to their perspective of the world. It receives each story scripts internal rating values, rated from 0-100%, and identifies the story script with the highest rate at that moment in time. If the rating is high enough it triggers the story script to proceed with its plot.

2.3 GIS Module

We use widely available GIS location data as a basis for the application allowing a fictitious world to be constructed around and within the physical environment. GIS mapping data includes layers of physical objects such as road networks, street signs, buildings and topographic features which can be linked to the game database. The map is processed in a GIS server module in order to predict which objects will occur on the journey, as well as their order and pacing during the upcoming movement through the landscape. The map processing converts the two-dimensional GIS data into a linear series of geographical event that are interpreted by the game event manager. These steps include *prediction of player's paths*; *extraction of visually available information* and *production of journey*.

Path prediction: The matching of the narrative to the surrounding geography is done with the calculi of a prediction about how far the car will move in the near future. The prediction is done based on available route options ahead of the vehicle i.e. in the current direction of the vehicle.

The algorithm starts by searching for a road ahead of the current GPS location, by identifying one of the road boundaries. When a path is identified, the algorithm follows it forward until a junction is reached and the road branches. From there onwards, the two different road boundaries will be followed until another branching occurs etc. The algorithm will stop after either one of two threshold values is reached. These values are either reaching the maximum distance of the path from our current location (this value is set to 1000 meters in the implementation) or reaching the maximum number of branch levels of the path (this value is set to two). These values can be dynamically updated to adjust for speed, for example, to allow for a variable window of future events.

The test implementation only provides data on the path to the first branch to the game event manager. However, the path prediction continuously occurs up to two branch levels ahead in the GIS module. This allows for quicker completion of upcoming requested data to the game event manager. The algorithm depends on reliable GIS data. Failures will occur e.g. if a gap occurs in the road side boundaries. To reduce the effects of such problems, the path prediction algorithm will restart and begin a new search for a suitable road on encountering such an error. In the meantime, the system continues running non-location based events.

Extraction of visually available information: GIS data contains point objects, line objects and area objects, which represents e.g. houses; roads; forests; elevation curves boundaries. The objects are sorted into different map layers, i.e. files in the data base and marked with different categories of the map supplier's choice. In order to provide an experience where the visual geography has meaning in the narrative, as seen by the player, we need to select the objects available in the map layers that could possibly be seen from the road. Abstract objects, e.g. political borders, are not considered as useful. However, some of visually available objects are only implicitly available in the map information. We then extract such objects e.g. intersections, by use of algorithms customized for that specific object.

The process of selecting layers and processing map information for implicit information is dependent on categories and layering provided by the map manufacturer. In this prototype we use map data from two different manufactures. Altogether we use about 50 different categories of objects and only one algorithm for implicit information extraction.

Mapping objects to journey experience: The next step is to combine predicted paths, with the extracted geographical objects, to generate what we define as a journey event list. A journey event is a prediction of an important visual event occurring along the path ahead involving a geographical object. In the current prototype we have so far define three different events i.e. passing right, passing left and crossing. Passing right is defined as the closest point where the distance to the object goes from decreasing to increasing and the object is to the right of the car. Passing left is the same only with the object left of the car. Crossing is the point where the predicted path intersects with a map object.

To further distinguish the visibility of the objects we also predict the distance and direction to it, as well as the frequency in which they appear. The assumption is that unique objects close by in the middle of your field of view are more visually important than others.

3 Conclusion

The prototype implement has been tested in a performance test as well as an initial user test. Even if more comprehensive user tests are ongoing, the preliminary results demonstrated that the current implementation provides a game experience according to the concepts described. Thus, the system we designed and implemented meets the requirements defined to build what we refer to as a believable environment in pervasive gaming.

First, it introduces and references to geographical objects with preserved everyday meaning in the story based game. The implementation manages to find GIS data in the vicinity and link that to stories, which were presented to the user. Second, a believable narrative environment should surround the location of the player. It follows that the data should be available along the whole road network and that it should have enough density to provide story experience almost anywhere. The implementation covers an area of around 35 square kilometers (around 41 000 inhabitants), which is per se much larger than other similar narrative environments. Furthermore, the concept is easily scalable if more GIS data is added covering larger geographical areas. Third, the system should match the story to the journey experience, rather than fitting stories to individual locations, to create believable environments. The prototype generates story segments which both made sense in their temporal order as well as their referencing to locations in the story. Finally, the player should mix the interaction with the devices and with the physical surrounding to generate a coherent experience. The implemented user interaction is audio centric, where most of game and narrative features are presented as sounds. Additional interaction through movements is integrated with audio in the form of a directional microphone. The intention has been to allow as much visual focus as possible on the landscape. However, for practical reasons the response to the speech is designed as a selection of options from a list display on the screen, rather than as speech recognition.

Future work will consists of a user evaluation and development of content. We will also investigate the possibilities for user content creation to further improve believability of the environment.

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References

1. Malaka, R., Schneider, K., Kretschmer, U., Stage-based augmented edutainment, In proceedings of Smart Graphics: 4th International Symposium, SG 2004, Banff, Canada, May, 2004
2. Bell, M., Chalmers, M., Barkhuus, L., Sherwood, S., Brown, B., Rowland, D., Benford, S., Hampshire, A., Capra, M., Interweaving Mobile Games With Everyday Life, In Proceedings of SIG CHI 2006, April, Montreal Canada, ACM
3. Crawford, C., Chris Crawford on interactive storytelling, New Riders, Berkeley, CA, 2005
4. Appleyard, D., Lynch K., Myer R., The view from the road, MIT Press, Massachusetts, 1964
5. Brunnberg, L. and Juhlin, O., Movement and Spatiality in a Gaming Situation - Boosting Mobile Computer Games with the Highway Experience. In Proceedings of Interact'2003 - IFIP TC 13 International Conference on Human-Computer Interaction. IOS Press, pp 407-414.
6. Brunnberg, L. and Juhlin, O. Keep your eyes on the road and your finger on the trigger - Designing for mixed focus of at¬tention in a mobile game for brief encounters. In Proceed¬ings of the 4th International Conference on Pervasive Com¬puting. Springer Verlag.
7. Crawford, C., Chris Crawford on interactive storytelling, New Riders, Berkeley, CA, 2005
8. Crow, D., Pan, P., Kam, L., Davenport, G., M-views: A sys¬tem for location based storytelling, ACM UbiComp 2003, Seattle, WA, 2003
9. Flintham, M., Benford, B., et al.: Where On-line Meets On-The-Streets: Experiences with Mobile Mixed Reality Games. Proceedings of CHI'03, Conference on Human factors in computing systems, Ft. Lauderdale, USA (2003) 569 – 576
10. Kretschmer, U., Coors, V., Spierling, U., Grasbon, D., Schnei¬der, K., Rojas, I., Malaka, R., Meeting the spirit of history, In proceedings of Conference on Virtual reality, archeology, and cultural heritage, Glyfada, Greece 2001
11. Mateas M., Stern A., Façade: An Experiment in Building a Fully-Realized Interactive Drama, Game Developers Confer¬ence, March 2003
12. Nisi, V., Wood, A., G. Davenport, L. Doyle, Hopstory: an interactive, location-based narrative distributed in space and time, In proceedings of Second International Conference, TIDSE 2004, Darmstadt, Germany, June 24-26, 2004.
13. Szilas, N., IDtension: a narrative engine for interactive drama, In proceedings of Technologies for Interactive Digi¬tal Storytelling and Entertainment (TIDSE) Conference, 187-203, 2003.