Physical environment games supported by wearable platforms

Zhendong Chen, Erik Koch, and Petja Möller

Fachbereich Mathematik und Informatik
Universität Bremen
{zhendong, ekoch, petja}@tzi.de,
http://peng.informatik.uni-bremen.de/

Abstract. This paper describes the effort of 21 students in a studentic project with the aim to create a game in the area of wearable computing. Thru the lack of design principles we developed our own concept to design new games. On this way we were faced with some problems. These problems and the way we solved them will be announced in the methods and technical realization part of this paper.

1 Introduction

The goal of the studentic project PEnG at the University of Bremen is to create a game which deals in the new area of wearable computing. A game in this area will connect the real world with a virtual world together. The player moves in the real world and interact with the virtual world we create.

The main problem we were faced within our project was the lack of literature in designing games on such a platform. Cause of this abuse the project decide to create a new way of designing games. An approach to design a game for wearable platforms will be shown in the methods part of this article.

Technical feasibility is another problem we have to handle. Some technical problems could be solved in different ways and we have to decide which solution will be the best with the background of gaming.

But our real motivation was to connect people together. Normally the most players play on there own and so the communication between them is very poor. The potential of a game which will be played in the real world is much more higher than in a desktop game. Communication between player is one of the main aspects in such a game. Without a meaningful communication between them they cannot reach any aim in such a game. Social cooperation is a wattle which have to be taken and this is the challange we will offer.

2 Methods

Before we go into technical details we give a little summary about our game concept. At the beginning of our project we adapted three desktop games to our wearable platforms. Our outcomes let us understand that adaptions of desktop games will mostly fail in the area of wearable computing.

So we decide to design a new game concept. The first steps was to create a big library of existing games in every area. For our library we choose desktop games just as famous board games.

As next step we extract the game concepts out of them. These subconcepts were evaluated along three different criterias. The first criteria is called BIZ. This criteria should show us if a subconcept is affordable in the project. For example the position of players could be one of this subconcepts. The accurate position of a player can be realized in different ways. All these ways also differs in the used hardware and so in the affordance of them. Another criteria is TEC. Here the subconcepts were analysed along there feasibility. This criteria also is linked to the BIZ criteria but the analysis have to be independent from there results. The last and important critertia is FUN. Like the name the subconcepts were provedon there amusement.

The outcomes of these analysis were necessary to find subconcepts which habe to be a part of our final game concept. As a result we developed a game design document for a realtime strategic game which takes place in a future scenario.

2.1 The Game

To get a feeling about the game we develop his section will give a detailed view on the game concept.

Our game is a art of strategy game, it is base of a classic desktop game with wearable devices. The players of the game is using the global position of the player as mouse pointer. The player moving around selecting where to place his virtual building. "In the bilding" has the player possible extensions to do. After the construct can the player select it and do the possible operations.

The player selects a operation and the building tries to process it until the player interrupts the action. For example in a research center the player can research some updates for units or upgrades for buildings which will have a permanent effect on them. In a recruitment center the player could afford units for fighting against other players or defending the own base. The idea behind this concept is to evaluate the virtual world by cerating virtual buildings towards the opponents base and afterwards occupy the basement of him. Another aim in this game can be to achieve a speciall amount of ressources or extend the basement to a certain size.

The player gets an overview about the field by using a little map. Only virtual buildins will be shown on the map. If the player goes to one of this virtual buildings a new menu will be available to him. The new commands a player can perform depends on the virtual building he has reached. For example the player could research some new techniques or updates when he reaches a research center. To command an attack the player have to enter an outpost.

The aim in this game is to occupy the headquarter of the opponent. To reach this aim player can play on there own or try to achieve the aim by playing in a group. The group gameplay is very different from the well known group gameplay components of other games. In desktop games the team members usually have no access on ressources and units of other team members. Complement to that concept any team member can command units of other team members and use there ressources. Advanced to this concept the communication beetween the players have to be more pricise than in other games.

2.2 Architecture

Here we give you an overview about the rudimental architecture (see fig. 1) of the game. Along the architecture you can see that the external hardware could be exchanged without implement new interfaces. By using this architecture we could benchmark external hardware like GPS receiver.

The server recieve the position and actions of a player and sends the new world status to the clients. For communication we have create an audio interface. This interface can be exchanged in consideration with the connection to the server. If there is a connection thru a wireless local area network with 54 MBit/s the audio codec should be better than you are using the UMTS network.

The serverside gamelogic part is the body of the game. All calculations will be made here. On the clientside the gamelogic will adminstrate the world model. The world model will create the visual user interface on the client and also handel all input the player made. So the visual user interface can be exchanged without touching the world model. Within this we can benchmark different kind of graphical user interfaces against each other.

3 Used techniques

As output interface we use a head-mounted display (HMD). The HMD shows the game information in our GUI interface.

The player will be equipped with a xybernaut wearable computer and some external hardware. For positioning we use a localization receiver so the game

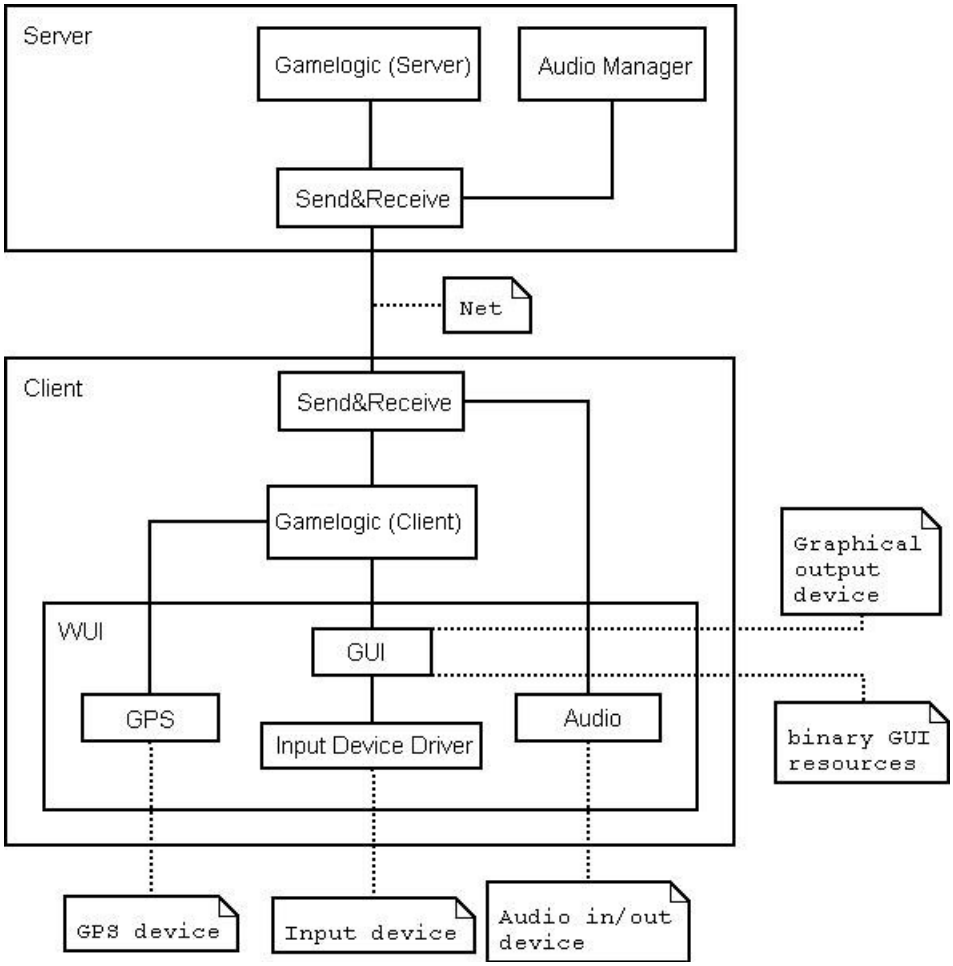

Fig. 1. Architecture

can take place outside of any building. In our game at every time the player must know where he himself is located in the map and where the objects and the opponents are located. For this we need a localization system. For an efficient localization we can use either the AGPS or DGPS system but we use the GPS technology for localization regarding the costs of AGPS and DGPS. In respect to our system architecture it will be easy to change to any other localization system later. The map of the game will be created using GPS coordination and every player and objects (e.g buildings) will be shown in the map.

At the moment the player is connected to a wireless local area network for transmitting the data. These kind of data transmission can be replaced with other techniques like UMTS. For example if the game takes place in a larger area on some place in the university near a building, we can use a WLAN access point as our communication interface. It is also possible to use the UMTS technology in our system architecture for our game. UMTS is a modern technology for the data transport. It has a larger coverage of signal, so we can play anywhere if an UMTS signal is available. The transport rate of UMTS is by 384 k/s at the moment and this is enough for the transmission of game data.

Another input system is a self designed joystick. The joystick can be used with one hand. On the upper end of the joystick there are three buttons and one miniaturized joystick head which can be controlled with one finger. The multiple combination of the buttons are adapted for our game GUI interface. One can use other input devices but it should be applicable in respect to wearable computing aspects and adaptable for the game GUI.

4 Related Works

The developement of our gameconcept was influenced by some games and projects. Three related works became a kind of base to our work. In the following the two desktop games and a mobile augmented reality game are described.

The base of realltime strategy games can be found in a game developed in 1992 by Westwood Studios. Still games in this genre uses the rudimentary parts invented by this game. This influencing game based on a novel from Frank Herbert is called Dune II [1].
The main task of the Dune II player is to choose one of the Households and build up a base consisting of several different buildings and moveable units. The units alter in their skills to defend from and to strike against antagonistic units. To afford the game aim of being military dominant above the other players it is necessary to gather resources in the game environment. With the resources the player pay the build costs for units and buildings. Winning the game is done by wiping out all enemy units. This concept of gaining resources, arrange a base, attack enemy units for military dominance are milestones in the genre of realtime strategy games and therefore very interesting for our development.

In addition to Dune II we found another innovative game concept. The game concept of The Settlers[2], also founded in the area of realtime strategy but less dynamic through some conceptional differences exemplified in the following. First conceptional difference is the weighting between setting up base and fighting against others in the time line. In the beginning the absolute priority is to arrange the base and to collect necessary resources. Every partie has a boarder surrounding the buildings and is expendable by military buildings. Required for a first struggle between two parties is an military building on each side. Continuously it is necessary to have a collective boarder or for the two buildings not to be too far away from each other. It is not possible to control the units themselves but giving specified instructions. That means an attack instruction can be specified only to military buildings of opponents. The units move and fight automaticly by their self. Winning the game is done by wiping out all other players units and buildings. This can be achieved by seizing military buildings because seized buildings expand the boarder. All hostile buildings that are within the new boarder burnig down immediately.

The Project ARQuake[3] developed at the University of South Australia in 2000, break ground in the connection of virtual and real environment in a game. By using the disciple of augmented reality ARQuake shows virtual game elements in the real surrounding with the aim to transfer the first person shooter Quake[4], developed by id Software in 1996, to a mobile game. The game aim of ARQuake is to walk through the physical environment and shoot on enemys which are displayed on HMD. The player is equiped with a backpack full of sensors and in the hand a weapon for aiming enemys. The GPS for localization, internal sensors for orientation and optical sensors for the context aware display of augmented elements are techniques they use for the translation.

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