Station *"name to be chosen with the local population"* Multi-user Platform

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This paper describes a mixed reality participative game that uses the physical space with an embedded system and the virtual space of the Internet with a multi-user platform and a database. The game has a permanent character as a multi-user platform and a temporary one as an event. Its aims are to locate nineteen RFID identifiable tags encapsulated as letters that form the phrase *Mar Memorial Dinâmico* (Dynamic Memorial Sea) dispersed in a mangrove, to supply a database, and to map the mangrove area that will be chosen together with the local population and research institutes, where the embedded system will be implanted. The game aims at promoting environmental education, raising ecological awareness and showing the need to preserve the ecosystem. The participants are represented in the multi-user platform by avatars of the local fauna.

Supplying the database and mapping the area, the game aims to preserve the ecosystem by collecting data through the embedded system and through explorations in the physical site. Thus, the game will collaborate with educational actions directed to the community and with environmental programs for the mangrove. In addition, it enables network collaboration, knowledge construction through participation and exploration of the concrete environment in the physical area, and the organization of the data, making them available to the community. The game is open to teams of participants and occurs through the exploration of the physical site and the collection of information that will build the virtual environment. As an event, the game will go on until the floor plan of the multi-user platform in the Internet is satisfactorily filled with information, which will be collected by means of the exploration of the physical space and the location of the letters of the phrase *Mar Memorial Dinâmico* (Dynamic Memorial Sea), dispersed in the mangrove.

Station "name to be chosen with the local population" Multi-user Platform System development
The first stage of the project encompasses the modeling and development of the multi-user platform with the database, as well as the development and implantation of the embedded system. In the second stage, the game will be performed as an artistic event. The number of participants will be increased and the data collections will be enriched.

In the physical space, the embedded system will be implanted in the mangrove area. The embedded system comprises three microstations, which are the sensor points, and nineteen letters developed with ecologically appropriate material, which encapsulate the RFID identifiable tags. Two of the fixed points of the micro-stations will be implanted in the mangrove area that is adjacent to the sea, and a third one at the mouth of the river as it flows into the sea. The microstations remotely monitor levels of temperature, oxygen, pH, ammonia, and phosphorus in the reserve water, data that are valuable to the biologists who study the local ecosystem. They also monitor the movement of the identifiable tags that are the letters. The letters M, A, R, M, E, M, O, R, I, A, L, D, I, N, A, M, I, C, O are the encapsulated identifiable RFID tags. These will be spread on the ground and on the water of the rivers in the mangrove area.

In the physical space of the mangrove, the implanted embedded system facilitates the collection and the multimedia supply of the database. It also functions as an aid in spatial and geographical location and in mapping the area that contributes to the representation of the area corresponding to the physical space in the virtual floor plan.

In the virtual space, the multi-user platform is a floor plan of the environmental protection area of the mangrove. The platform as a virtual environment has a structure that allows distance real-time information exchange between the participants, establishing a dialog between the teams that act online and in the physical site. In addition, the teams can see the letters spread in the physical site on the ground and in the river, where they are located. Finally, the teams can consult the database supplied with texts, audios, videos and animations based on the collections carried out by the participants in the physical site and on Internet searches.

The floor plan in the multi-user platform will be gradually filled with the data collected both by the participants who are acting in the physical area and by the online participants. In the floor plan, niches of the local flora modeled in 3D, corresponding to the area in the physical space, will be made available when the sensor microstations show the passage of one of the letters. **The collections** are carried out in the **physical space** of the area by mobile technology with an interface to the sensor microstations, which form, together with the letters, the embedded system, or in home PCs; **and in the virtual space** of the platform in the Internet, by
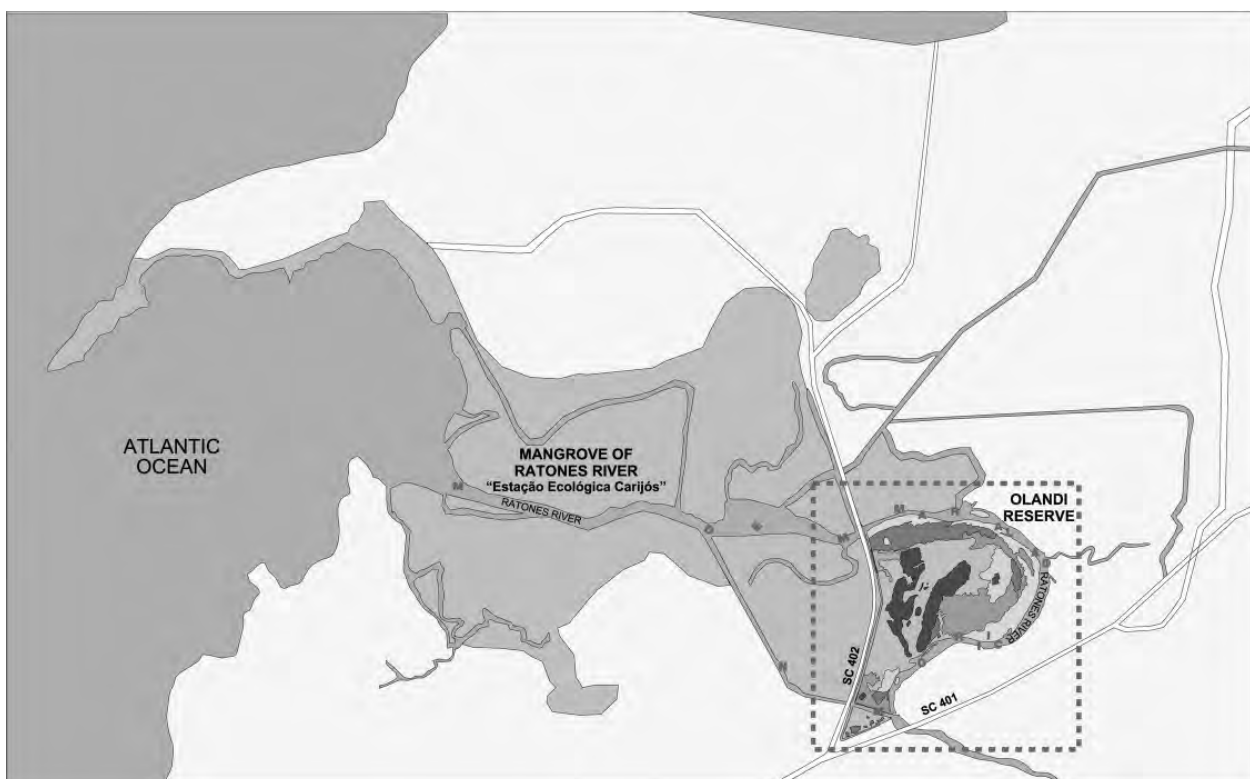

Figure: Map of a possible area of the Olandi Reserve in Florianópolis, state of Santa Catarina, Brazil, with the meander of the original bed of river Ratones.

search software. In the Internet floor plan, the collected materials corresponding to the letter **A**, for example, form one collection group. After the letter is located **in the physical space**, they occupy the area around it in the virtual platform. As the collections such as videos, sound captures, fixed images, textual data and icons representing the local flora are made available, after they have been previously modeled in 3D, together with the data about the movement of the letters in the physical area, the floor plan is gradually transformed into the virtual environment Station "name to be chosen with the local population" Multi-user Platform. The collected data are pasted to the floor plan as geotagging,

gradually occupying the multi-user platform by means of participation.

The creation of the virtual environment happens as the collections are performed and the space is filled with the multimedia resources collected in the concrete space of the reserve. Thus, the game enables the immersion experience, intersecting both spaces: the physical site through the exploration of the mangrove and the virtual site of the Station "name to be chosen with the local population" Multi-user Platform. It establishes networks of interactions: human versus human, human versus animal, human versus environment, human versus technology, real and concrete versus virtual.

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