# "Aedes Vs. Repellents": Applying Tower Defense Dynamics in a Digital Game to Combat the Mosquito

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Abstract. Serious games represent a computational resource that can be used as a tool to create new ways of raising awareness of digital natives. In this sense, this paper presents current results with the "*Aedes vs. Repellents*", a 3D tower defense game that aims to promote the interaction and learning of the population in the prevention and combat of the Aedes aegypti mosquito. For this, mechanics and dynamics of the well-known "*Plants vs. Zombies*" game will be reuse, being applied in a scenario capable of providing a context of public health learning in the prevention of the mosquito.

Keywords: Game design · Aedes aegypti · Serious games

1 Introduction

Aedes aegypti is a mosquito that acts as a vector for the transmission of recurrent diseases in public health with alternating outbreaks and difficult-to-combat epidemics, such as dengue fever, yellow fever, chikungunya and zika virus [3]. As a result, several educational campaigns have been developed and increased over the years in mosquito prevention and control involving science, education and coordinated arts activities with schools, students, parents and teachers [5].

Educational games, also known as serious games, are types of software primarily aimed at educational purposes [7]. It is a computational resource that can be used as a tool to create new forms of dissemination, as well as implement educational actions capable of increasing the public interest in combating the mosquito [8].

However, there are evidences that define serious games as a boring alternative for their players, being focused on learning aspects instead of promoting pleasure and enjoyment for the player [1]. In fact, promoting the relationship between

playfulness and learning is a major challenge during the process of designing and building a serious game [1].

In this sense, and considering the reuse of mechanics and dynamics of successful games to be applied in a scenario that provides a health learning context, this article presents the "*Aedes vs. Repellents*" project. It is a game that seeks to apply available mechanics and dynamics of the "*Plants vs. Zombies*" [2] game in a context where the player has to protect a house suffering from constant waves of mosquito attacks.

2 Related Work

Different types of serious games have been developed in the context of combating the Aedes aegypti mosquito. As an example, the Mission Aedes [1] features a 2D platform style game that seeks to: remember which is a mosquito focus; understand and analyze the life cycle of the mosquito; apply knowledge acquired regarding mosquito outbreaks; and evaluate the development cycle of the mosquito. Following the graphic quiz style the *Aedes Game* [6] aims to inform the Brazilian population about their social responsibility in the fight against Aedes aegypti, providing a set of questions and answers that seek to inform the player by feedback of the given responses. Finally, the *Aedes in the Sights* game [4] uses virtual reality to propitiate an immerse backyard of a house full of dengue spots, where the player must eliminate all the mosquito larvae found.

3 The "Aedes vs. Repellents" Game

The general objective of the proposed game is to avoid the player house invasion by mosquitoes (Fig. 1). In this sense, as a protection strategy, the player must build defense towers, in this case repellents, able to avoid mosquitoes but with an energy consumption each one.

Fig. 1. Initial menu of the "Aedes vs. Repellents" game.

To use energy, the player needs to build solar panels and batteries to generate and store more energy as soon as possible. These resources are necessary to allow the player to be protected at night, when the wave of mosquitoes begins to attack the player residence.

The game difficulty will increase according to the subsequent mosquitoes waves, along with the mosquito variations that can both destroy the towers more easily and also offer more resistance to player damages.

As examples of game modeled characters: the insecticide is the base attack structure (Fig. 2(a)) to kill mosquitoes; the plug repellent and the grid protection work as defense units (Fig. 2(c) and (b)) against the mosquito wave; and the special mosquito that does not fly provides a hull that gives a greater resistance to damage promoted by repellents (Fig. 2(d)).
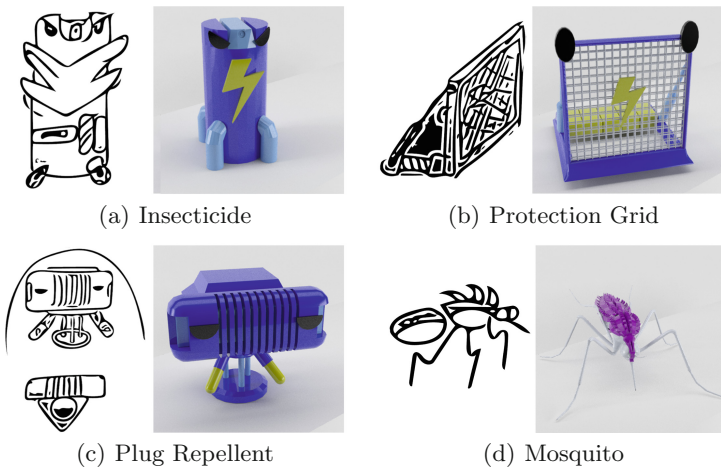

(a) Insecticide   (b) Protection Grid

(c) Plug Repellent   (d) Mosquito

Fig. 2. Designed characters of the "Aedes vs. Repellents" game.

The initial scenario of the game play presents a 3D environment, containing the tracks where the elements of the game will be placed to avoid the invasion of the mosquitoes to the residence (Fig. 3). New mosquitoes are applied in each track per night wave, being increased by amount, speed and resistance in each mosquitoes attack, according to the continuous survivor state of the player.
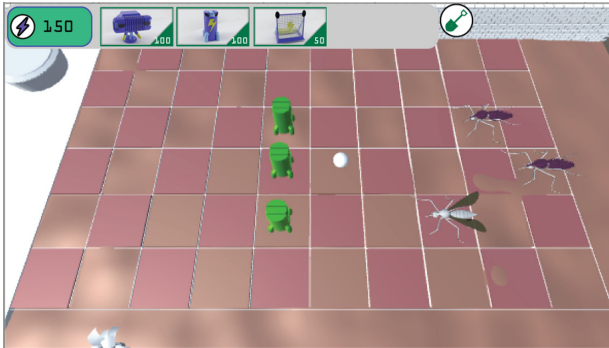
Fig. 3. Initial game play of the "Aedes vs. Repellents" game.

4   Conclusions and Future Work

This paper presented the "Aedes vs. Repellents", a game that aims to apply digital entertainment in the prevention and combat of the Aedes aegypti mosquito. It is a playful application that aims to use mechanics and dynamics of the Plants vs. Zombies game in a scenario where the player has to protect a house from mosquito attacks using real prevention and combat elements such as repellents, grid protection and insecticide.

As future work, in addition to the completion of the game (available at https://github.com/lenda-uefs), it is important to be integrated with social networks, expanding the game reward system to the external and cultural environment of the player. The addition of new characters and multimedia resources, followed by future participation in health campaigns, and the production of educational materials related to the game, will also be performed in the future.

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