Developing a Mobile Virtual Reality Game to Support the Fight Against the Aedes Aegypti Mosquito

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Abstract—Nowadays, there is a need to create alternatives to improve the fight against the Aedes aegypti. Traditional marketing strategies to combat the mosquito have not obtained satisfactory results, especially for the younger audience. As an alternative strategy, this paper presents the development evolution of a serious game that seeks to bring relevant information about the fight against the mosquito. It is based on virtual reality and mobile resources able to increase the immersion and engagement of the young audience, as well as providing a simple and fun serious game for the end user.

Index Terms—aedes aegypti, fight against mosquito, serious games, virtual reality, mobile games

I. INTRODUCTION

Year after year, Brazil is experiencing a *dengue* epidemic and related diseases caused by the *Aedes aegypti* mosquito. In fact, considering the number of cases recorded in 2019, the Ministry of Health reported more than 450 thousand cases of this disease, together with 3085 cases of *zika* and 24,120 cases of *chikungunya* [1]. Therefore, it is necessary to do something to combat this threat, and a way to do this is through education.

The National Dengue Control Program (PNCD) recognizes the impossibility of eradicating the mosquito, but it has a series of components that aim to contain the epidemic, including social mobilization, health education and communication [2]. In this sense, it is necessary to include other ways of transmitting knowledge to the population, going beyond the traditional advertising campaigns that are disseminated by communication vehicles.

Educational digital games, also known as serious games, represents another alternative to fight against the mosquito. It is a class of games that aims to simulate practical situations, with the aim of providing training for professionals and decision making in critical situations, raising as a result the awareness among children, young people and adults, as well as education on specific topics [3].

This paper presents the development evolution of **Aedes na Mira 2.0** (in english, Aedes in Sight 2.0) [4] to a mobile and virtual reality game that aims to educate in the fight against the Aedes aegypti mosquito. It is a game focused on a public aged between 10 and 16 years old, which makes use of Virtual Reality (VR) and the Android platform to intensify the interest of the young audience about this subject, as well as providing a greater immersion of them in the proposed game.

II. RELATED WORK

Several games have been developed about the fight against the Aedes Aegypti mosquito. As an example, *Missão Aedes* [5] (in english, Mission Aedes) is a 2D platform style game that seeks to: remember which are the mosquito's focuses; understand and analyze the mosquito's life cycle; apply the acquired knowledge regarding the mosquito outbreaks; and evaluate the mosquito's development cycle.

Another example is the *Aedes na Mira* [6], a mobile VR game that provides to the player an immersion in the yard of a house full of dengue outbreaks, in which he must eliminate mosquito larvae contained therein. However, this game do not allows the user to play with buttons on the screen, as well as the use of controls to move the character, being characterized as a rail-shooter without shooter buttons, together with a limited interaction in the proposed VR environment.

III. METHODOLOGY

Aedes na Mira 2.0 was developed using the Unity engine for the Android platform. This game engine is capable of providing a VR support via Google Cardboard for advanced mobile phones, as well as a screen interface for mobile phones with a limited hardware. By the VR interface, it allows the user to navigate and interact in real time with a 3D environment through the use of multisensory devices for performance or feedback [7]. By the screen interface, it allows the player to performs all movement to play the game, as well as all necessary interactions to buy and use game items, through available buttons.

To play the game, the Bobo VR Z6 glasses was used, together with the standard Bluetooth control of the Microsof Xbox360 console (Fig. 1). When starting the game, the player must choose if he wants to play on the screen, to play with virtual reality and control, or to play with screen and control. In this case, both virtual reality and screen with control requires

Fig. 1: Bobo VR Z6 glass and IPEGA PG-9021 bluetooth controller.

Fig. 2: Graphic options window in the mobile screen and the diegetic VR modes.
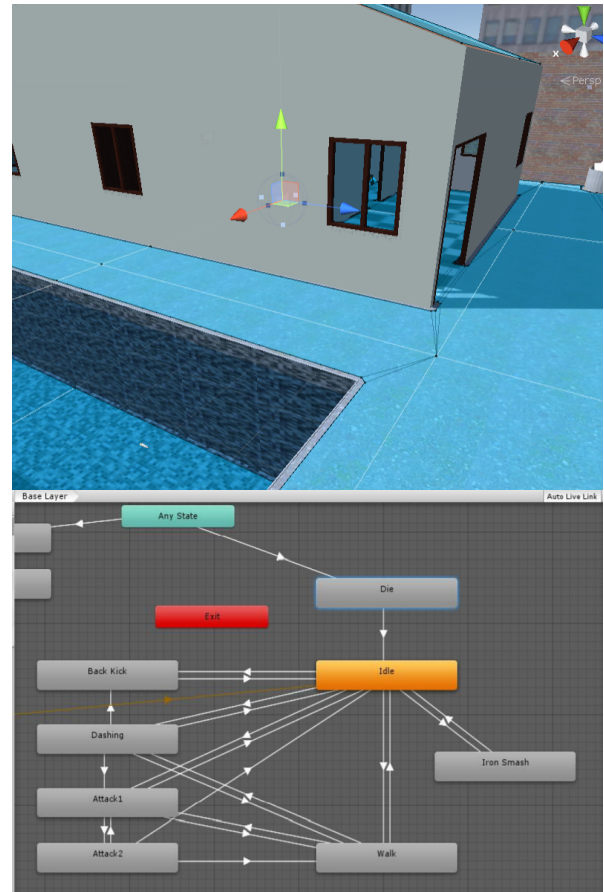

Fig. 3: Example of a blue zone for the mosquito navigation defined by the Navigation component, and an applied state machine for the game.

a manual configuration for standard Xbox360 controls, such as IPEGA-9021 (Fig. 1). If an Xbox One controller is used, there is a system in which the game recognizes it automatically, eliminating any process of manual configuration.

Regarding the game performance, some graphical resources were chosen (FPS, LOD, Anti-aliasing, Anisotropic, shadows, etc.) to be applied and configured via graphical interface in the proposed game (Fig. 2). By them, an initial performance evaluation was applied for the game, where the use of shadows in a mobile phone with a limited hardware presented a stuck and less fluid game execution, together with a great difficulty to move the player around modeled game scenes. As a consequence, some graphical options were defined as static and pre-defined for the game, according identified hardware limitations.

For the Artificial Intelligence (AI) of the player enemies, they make use of state machines to move and to render their animations, as well as *Navigation* and *Nav Mesh Agent* component to control their movements around a defined area of each phase (Fig. 3). Navigation is used to back up an area that can be traversed and not traversed, while the Nav Mesh Agent is a component attached to a game object, which will