

Augmented Dodgeball with Double Layered Balancing

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ABSTRACT

Playing is most fun when the end result remains unsure until the last minutes of the game. In team games, this means that both teams have comparable skill levels. When playing for fun, this can be hard to accomplish. Instead, game balancing can be used. We introduce a double layer balancing system for dodgeball. Augmented Dodgeball uses a virtual layer to balance differences in the physical world. In the virtual layer, players can choose their character they wish to play in the game. This contributes in more collaboration and teamwork during the play. In addition, we introduce individual parameters to each player based on their self-assessed skill level. These changes will not be introduced to the players. This allows for a more seamless balancing between player's physical skills without publically labeling the players based on their skill levels.

Keywords: Augmented Dodgeball. Augmented Sports. Exertion Games. Game Balancing. Sports. Video Gaming.

Index Terms: Human-centered computing~Mixed / augmented reality

1 INTRODUCTION

Research has shown that a close competition even when some players are assisted, increases the level of fun while not changing the level of fun that the player who did not receive any benefits have [1]. In some games this has been done by adding additional rules. For example, in dodgeball, weaker players are sometimes given several "lives" which means that they can get hit several times before becoming an outfield player. Or more skillful players are only allowed to use their non- dominant hand for handling the ball. Although these rules are made to balance the skill levels between players, there are several problems arising. First, it labels players into strong players and weak players. Research has shown that this kind of labeling does not contribute to the gaming experience. Instead, the enjoyment is higher when balancing is done hidden from the players [2]. Players may or may not know about the balancing, but the exact details would not be known. The second problem with adding additional rules is that it adds to the cognitive load for the players. They have to keep in track and remember all the additional rules and therefore additional rules take away attention from the game itself.

2 AUGMENTED DODGEBALL OVERVIEW

Augmented dodgeball is a game that takes place in two dimensions: the physical layer and the virtual layer. The physical

layer means that it is still a ball game and players throw ball at each other in order to win the game. Virtual layer means that all players also have virtual parameters like attack power, defense power and life points like known from computer games. With this virtual layer, we can add additional game elements without creating cognitive overload to the players as they do not have to track and remember all the additional and sometimes complicated rules. Instead, they can track the state of the game and let the computer systems do the work of tracking all the rules set by the game designer(s).



Figure 1: Augmented Dodgeball game

First balancing layer involves letting players choose their virtual character. In augmented dodgeball, players are aware of the fact that different player roles have different virtual parameters and who is better in what skill. This means that the game can become more strategical. The design insights of Augmented Dodgeball are described in [3].

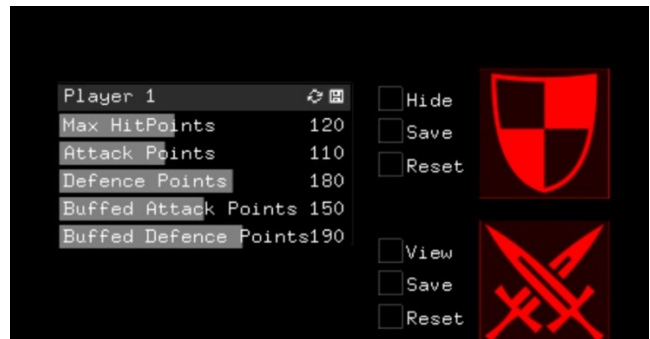


Figure 2: Referee can adjust all virtual parameters

The second hidden layer of balancing while playing augmented dodgeball is completely hidden from the players. This kind of balancing is designed to directly adjust the differences between the skill levels of the players. Before the game, players are asked to give a self-assessment about how good they think they are in dodgeball on a 5-point scale (1 being very bad and 5 very good). Based on that self-assessment, the player's parameters are modified by the referee. The main characteristics of the role that they chose will still remain the same (for example, attacker type

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players would still have high attack power and low defense power), but for a player whose self-assessment was low, the referee would increase their virtual parameters up to 10%. And for people whose confidence level was high, the referee would decrease the virtual parameters up to 10%. These changes would be hidden from the users and spectators. We hypothesize that the players are not able to detect the difference between the parameters and that giving a slight edge to the players whose self-assessed skill level is low would make them more confident in the game. And at the same time, for high performing players, their challenge level would be increased. The parameters can only be adjusted before the game.

3 TECHNICAL SOLUTION

In order to realize the Augmented Dodgeball game, we need to know which player is throwing the ball, what are their virtual parameters, who gets hit and a system to visualize the virtual layer.

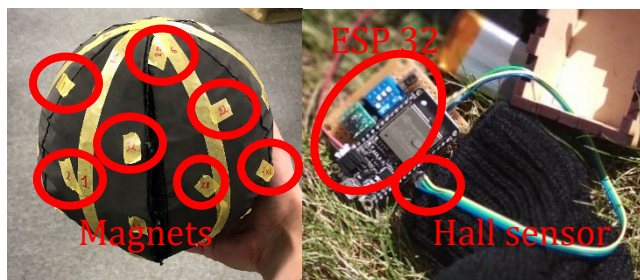


Figure 3: Catch detection system (Ball on the left and wearable device with ESP32 microcontroller and Hall sensor on the right)

The hit detection is made by the referee and entered to the system manually. Thrower detection is done automatically by the thrower detection device. This is a wrist device connected to a hall sensor that is placed on the palm of the player (Figure 3, right). All data is processed by ESP 32 microcontroller. The ball is equipped with magnets (Figure 3, left) When the player holds the ball, system detects the electrical field of the ball and sends a notification to the game database wirelessly.

The system overview can be seen on Figure 4. Hit detection system (manual) and thrower detection system (automatic) write to the Database. Game engine takes care of applying the rules of the game. Player and audience notification system visualize the virtual state of the game to all participants.

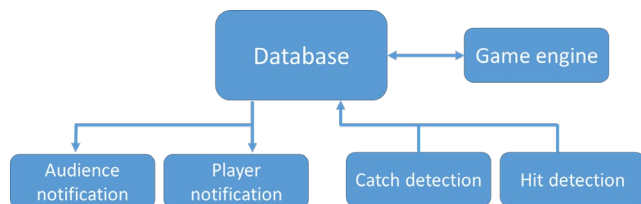


Figure 4: System diagram

The audience notification system and the player notification system is realized by a scoreboard next to the playing field. The score board features life point bars. When a player gets hit in Augmented Dodgeball, they are not out of the game, but lose life points. When the life points reach zero, the player becomes outfield player. The coloring on the life points bar indicates also how much life points are left with green being plenty, yellow medium and red meaning that after one hit, the player's life points

would be finished. On the right of the life points bar, the players' virtual role is displayed. (Figure 5)

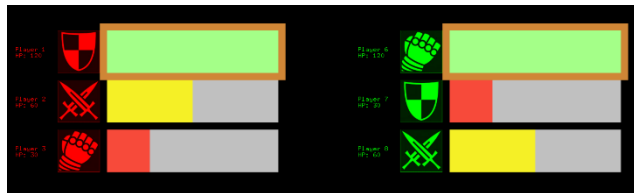


Figure 5: Scoreboard of the Augmented Dodgeball game

4 DEMONSTRATION

The demonstration involves playing Augmented Dodgeball. All players are equipped with the thrower detection device. Before the game, the players are instructed about the game and also fill out a survey about their presumed skill level. During the setup of the game, the referee assigns players their chosen role. In addition, the referee changes the parameters of each player based on their self-assessed skill level. The virtual powers of less skilled players would be increased up to 10% from the average points. The virtual parameters of more skilled players would be decreased up to 10%. But so that even if the strongest player would hit the weakest player (according to virtual parameters), they would not be out of the game after first got hit. One game involves 6 to 10 people, with 3-5 people on one team., The number of people in one team should be equal. One player starts as an outfield player and can join the game as an infield player only after one of their teammates has lost all their life points and become an outfield player. The game is played on a 2x4m field. The duration of one game is around 10 minutes. The whole demo session with game explanation, preparation and the game will last about 30 minutes. During the game, players can have a unique experience of playing both in virtual and real world. Their efforts are reflected on both worlds, creating an exciting new experience. Participants have described the Augmented Dodgeball experience as playing a role playing game in real world and have enjoyed the game. The new two-layered balancing system is designed to make the game result even more close, keeping the final outcome unsure until the last minutes of the game.

ACKNOWLEDGEMENTS

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