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# Digital Baseball Sport Design Based on DMC Gamification Theory

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**Abstract.** With the rapid advancement of digital technology, digitized sports have become a significant trend in the global sports industry. This study aims to explore how to combine gamification theory to achieve the digital transformation of baseball sports, enhancing the accessibility and popularity of baseball activities. This research delves into gamified digital baseball design by analyzing the characteristics and current status of baseball sports, along with the successful application of DMC gamification theory in the sports domain. It outlines user interviews and questionnaire surveys, and based on the research findings, proposes strategies for integrating gamified elements, enhancing interactive experiences, and providing typically motivational elements. These strategies infuse the concept of gamification into digital baseball design. Finally, this study engages in practical design, merging DMC gamification theory with baseball sports, aiming to provide users with novel and enriched baseball experiences, driving the dissemination and development of baseball. This research offers new insights and practical references for the development of baseball sports and the application of gamification theory in the sports domain.

**Keywords.** Gamification Theory, DMC Model, Digital Sport, Innovation Design

## 1.Introduction

With the progress of society and the improvement of people's living standards, the concept of national health has gradually become a focal point of social attention. The continuous development and application of digital technology will bring about more opportunities and challenges across various industries. As an integral part of social activities, sports equally benefit from the advancements in digital technology. Currently, new forms of digital sports have emerged, such as VR spectatorship, online fitness, and smart sports venues, marking digitization as a primary trend in the development of sports industries worldwide.

Among numerous ball sports, digital baseball gaming, as a popular type of sports game, contributes to physical well-being. Its exercise value and enjoyable nature attract a considerable number of sports enthusiasts. Baseball requires specialized training facilities and professional equipment, but the proliferation of digital sports introduces baseball to a broader audience, overcoming spatial limitations. However, for ordinary players unfamiliar with baseball, which is a sport rich in strategy and competition, there

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exists a notable learning curve. Novices find it challenging to attain a satisfying sports experience, leading many to abandon the sport in the early stages of engagement.

n recent years, gamification theory, as a design concept that emphasizes engaging participation and enhancing experiences, has gradually garnered widespread attention in the realm of sports. Within this context, the integration of gamification theory with specific sports disciplines has become a forward-thinking and innovative research direction, aiming to explore the role of digital design in increasing engagement and enhancing experiences. Merging digital baseball with gamification theory allows players to gain a deeper understanding of the rules, techniques, and strategies of baseball, elevating the awareness and comprehension of the sport. Moreover, the gamified approach enables players to delve further into experiencing and understanding baseball, fostering a passion for the sport and propelling its development. As an emerging genre of digital gaming, digital baseball gaming offers new opportunities and challenges to the digital gaming industry, driving its transformation toward inclusivity, diversification, and innovation. By leveraging gamification theory, this research envisions a prospective and innovative approach to enhancing sports engagement and experiences through digital design, demonstrating the potential for advancing both the sports and gaming sectors.

Therefore, the integration of digital design and gamification theory to infuse new vitality into baseball has become a topic of great interest. By incorporating gamified elements into baseball, it not only sparks athletes' enthusiasm and drive but also enhances the engagement and entertainment value for spectators. This contributes not only to propelling the development of baseball but also provides a robust practical example for the application of digital design in the sports domain.

In summary, this study aims to delve into the digitized design of baseball based on gamification theory. Drawing from successful instances of gamification theory in other domains and considering the characteristics and needs of baseball, the exploration involves optimizing various aspects of baseball through digitized design. Through in-depth research and empirical analysis, we aim to uncover the potential effects of digitized design in enhancing participation and allure within baseball. Ultimately, this endeavor aims to offer users a more enriched and satisfactory experience, providing novel insights and references for the future digital development of sports.

## 2.Literature Research

### *2.1. Theory of Gamification*

Gamification theory is a design approach that combines game design principles with non-game contexts, aimed at igniting participants' interests, enhancing learning outcomes, and elevating user experiences. Gamification, by introducing game elements such as challenges, achievements, rewards, etc., encourages active user participation and provides real-time feedback, thereby stimulating motivation and engagement. Gamification has been successfully applied in various domains including education, health, marketing, and has achieved remarkable results. It is suitable for behavior change, guiding users to cultivate positive habits. Kevin Werbach proposed that in the early stages of gamification, internal gamification, external gamification, and behavior change gamification are particularly prominent. Applying gamification to the field of sports and

fitness can increase user engagement and effectively alter their habitual behavior patterns.

The term "Gamification," coined by Nick Pelling in 2003, refers to incorporating game design elements and principles into non-game contexts to provide an enjoyable experience akin to that of gamers[1][2]. By 2010, Jane McGonigal's TED talk "Game can make a better world" brought global awareness to the profound impact gamification could have on the world[3]. It was at this point that "Gamification" began to be widely adopted as a specific design method. Consequently, the popularity of the term "Gamification" has increased each year. Various theoretical models are associated with gamification design, such as the DMC hierarchical model, Mechanics-Dynamics-Aesthetics model (MDA) for gamified development, and the Octalysis Behavior Analysis Framework[4].

Among them, the DMC (Dynamics, Mechanics, Components) model is one of the key concepts in gamification theory, proposed by Kevin Werbach in his book [1]. The DMC model divides into three levels: D (Dynamics), M (Mechanics), and C (Components), and conducts a detailed analysis of mechanics and components[5]. This model analyzes the structure and operation of games through these three core elements, providing designers with an in-depth understanding of the framework of game systems. Dynamics: Dynamics refer to various interactions and events in the game, as well as how these events occur and evolve in the game. It encompasses elements such as rules, behaviors, and interactions in the game. Dynamics create the fundamental operational mechanisms of the game and determine the actions and choices players can make in the game. Mechanics: Mechanics refer to the rules, systems, and interactions in the game, as well as the basic processes that drive the progression of the game and how these elements interact to lead to specific outcomes. Mechanics define how players interact with the game world, covering specific gameplay and operations. Components: Components are surface elements that can be directly perceived by users. Components are the concrete manifestations of dynamics and mechanics and are the most fundamental elements of gamification.

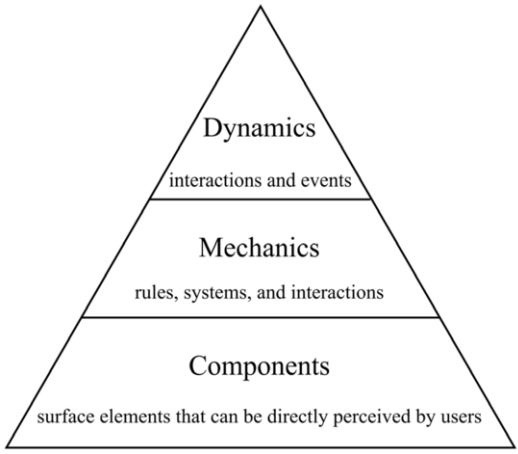


**Figure 1.** DMC theoretical model.

The core idea of the DMC model is that by gaining a deep understanding of the dynamics, mechanics, and goals of a game, designers can better create interesting and engaging gaming experiences. In gamification design, the DMC model is widely used to analyze systems and activities in non-gaming contexts, enabling the integration of gamified elements to enhance user engagement. In summary, the DMC model in gamification theory offers designers a systematic analytical approach to better comprehend and apply gamification principles, thereby optimizing experiences and engagement in non-gaming scenarios. In this study, we will explore how to apply the DMC model to the digitized design of baseball to enhance the experiences of both players and spectators.

### *2.2. Digital sports development status*

The rapid development of digital technology has profoundly transformed the landscape of sports, bringing forth new experiences and opportunities for the masses. Particularly in the realm of baseball, the integration of digital technology is propelling the sport into a more modern and diverse phase. Virtual reality technology stands out as another remarkable domain within digital sports. In baseball, virtual reality technology can be employed to create highly realistic game experiences, making spectators feel as if they are on the field themselves. Furthermore, virtual reality can offer innovative training methods. For instance, athletes can engage in virtual confrontations with virtual pitchers to enhance their batting reaction time and decision-making within a virtual environment. Simultaneously, virtual reality provides coaches with better perspectives for analyzing and refining athletes' techniques. Multimodal interaction technology emerges as a crucial innovation within the digital sports domain. In baseball, multimodal interaction technology finds application in various facets. During training, athletes can don virtual reality headsets to immerse themselves in a lifelike batting experience, while simultaneously hearing authentic stadium sounds, thus better simulating actual game conditions. Additionally, coaches can utilize multimodal interaction technology to analyze athletes' movements and offer real-time feedback, aiding them in continual technique optimization. Digital sports also emphasize the importance of real-time data analysis and feedback.

In conclusion, the integration of multimodal interaction technology and virtual reality technology, alongside the introduction of real-time data analysis and feedback, continually enriches and expands the potential of baseball. These innovations not only enhance the quality of games and training but also provides a new path for the future development of baseball.

### *2.3. Gamification theory and digital sports*

Gamification is considered both a collection of game elements and a process of creating gaming experiences to increase motivation for sustaining desired behaviors[6]. Numerous studies have integrated gamification theory with digital sports, and a wealth of literature attests to the positive impact of the DMC model on promoting exercise behaviors[7]. Áron Tóth, in his research, examines the effects of gamification in sports applications on individuals' exercise habits and performance. This offers a possibility for a broader user base to utilize motion tracking applications within gamified systems to monitor and analyze their performance, thereby maintaining users' engagement[8].

In virtual environments, athletes can safely experience their surroundings and interact with various objects even under controlled critical conditions[9]. Paula Bitrián's research findings indicate that interactions with achievement-related game elements within sports applications satisfy the needs for competence, autonomy, and relatedness[10].

In conclusion, gamification design offers a robust framework for digital sports, aiding designers in thorough analysis of various elements within sports. By employing gamification design models, the design and optimization of digital sports can be enhanced, providing athletes and players with richer and more immersive experiences.

## 3.Case Studies

This paper begins by analyzing existing cases of sports-related mobile applications, summarizing their commonalities and characteristics, and extracting design insights that can be applied. It then analyzes gamification elements that can be transferred to the digital baseball app. The digital sports app market offers a diverse array of choices, catering to both sports enthusiasts and casual players, ensuring that everyone can find an app suitable for their preferences. Currently, sports-themed games in the market have garnered immense popularity among the general public, prompting us to select five representative apps for analysis. The results are shown in Table 1.

**Table 1.** Sports APP case study

| Application | Image | Introduction | Type | Advantages | Features |
|---|---|---|---|---|---|
| FIFA Mobile Soccer |  | Players can create and manage their own football clubs and participate in competitions and tournaments | Football simulation game | Officially authorized players, teams and modes of play; Diverse competitions and events; Social interaction features. | Live events, build and upgrade teams, online battle mode |
| NBA Live Mobile Basketball |  | Allows players to form their own NBA teams and participate in competitions | Basketball simulation game | Official NBA players and teams; Multiple game modes; Team management and training. | Live matchmaking, playoffs, league formation. |
| PES Club Manager |  | Players can play as the manager of a football club, managing the team and the game. | Football manager simulation game | In-depth manager simulation experience; Official players and teams; Strategic and tactical planning. | Player training, transfer market, tactical setup. |

| | | | | | |
|---|---|---|---|---|---|
| Top Eleven |  | Players can create their own football clubs, participate in competitions and compete | Football manager simulation game | A variety of tactical and strategic options; Multiplayer online battle; Social interaction function. | Real-time games, club management, training of players. |
| WGT Golf |  | Various golf courses and game modes available. | Golf simulation game | Realistic golf experience; A variety of courses and game types; Social play. | Multiplayer online matches, real court simulations, challenges. |

By comparing these digital sports apps, several conclusions and perspectives can be drawn regarding the benefits of gamified sports apps in promoting user engagement and acceptance of a particular sport. For instance, (1) Enhancing Motivation and Engagement: Gamification elements such as achievements, leaderboards, and rewards can stimulate users' interest and motivation, making them more willing to participate in sports and use the app. (2) Creating Engaging Experiences: Gamified sports apps often introduce enjoyable challenges, interactions, and activities, offering users a more entertaining experience and increasing their desire to use the app. (3) Fostering Social Interaction: Many gamified sports apps allow users to compete, collaborate, and share achievements with others, creating a social interactive environment that encourages communal participation in sports. (4) Personalized Training Plans: Some apps can provide personalized training plans based on users' physical condition, goals, and interests, enabling users to tailor their exercise routines more effectively. (5) Overcoming Monotony: Sports can become mundane and repetitive, leading to loss of interest; however, gamified sports apps introduce new challenges and tasks to help users maintain their interest and motivation.

In this sense, with the growth of mobile gaming applications, gamified sports apps like Nike+, Strava, Fitbit, and Endomondo have significantly proliferated. Applying gamification principles, these apps incorporate various gaming elements such as challenges, medals, rankings, competitions, avatars, etc., to encourage and maintain habits related to physical exercise. Through this approach, they influence individuals to perceive exercise as a fun, enjoyable, and engaging activity, thereby boosting their motivation.

In conclusion, gamified sports apps, through a variety of engaging elements and features, can ignite users' interest, motivation, and engagement, leading them to participate more actively in a sport and continue using the app. This gamified approach can make exercise more enjoyable, challenging, and to some extent, enhance users' receptiveness to sports.

## 4.Methodology

Surveying and researching the target users is an indispensable part, and the selection of research methods in this paper is based on the user characteristics of sports apps. We determined the use of both questionnaire surveys and user interviews to comprehend user types and requirements. Table 2 outlines the research methods and survey objectives for different stages of the study. With the DMC model as the theoretical foundation, we conducted quantitative and qualitative analyses to uncover users' latent needs.

### *4.1. Procedure*

This study employs a method based on the DMC model, combining in-depth interviews and questionnaire surveys. The process is shown in Table 2. Initially, through in-depth interviews, user pain points are preliminarily explored to understand their perspectives on existing digital sports games. This serves as a foundation for further defining the design of gamified digital baseball. Subsequently, an online questionnaire is utilized to broaden the research scope, targeting individuals with an interest in sports, in order to further uncover users' underlying needs.

**Table 2.** Research procedure.

| Stage | Method | Users | Aim |
|---|---|---|---|
| step 1 | in-depth interview | People with experience in using sports apps | Excavate users' pain points, understand users' experience in using sports apps on the existing market, and initially understand the common problems and functional requirements of users when using them |
| step 2 | questionnaire survey | People who like sports | To further understand the psychological expectations of users and tap the potential needs of users |

### *4.2. In-depth interview outline design*

In this study, in-depth interviews and questionnaire surveys played a pivotal role in gaining a comprehensive understanding of individuals' attitudes, perspectives, and expectations toward gamified digital baseball design. In-depth interviews allowed for one-on-one in-depth discussions with respondents, enabling a more comprehensive grasp of their viewpoints, experiences, opinions, and actual experiences with gamified digital sports apps. This approach yielded rich detailed information, enabling insight into diverse attitudes and needs among different demographic groups, thereby incorporating greater diversity into the research. The in-depth interview protocol was designed to delve deeper into respondents' perspectives and opinions. Additional relevant questions were introduced based on respondents' answers to gather more detailed and comprehensive information. The interview process remained open-ended, allowing respondents to express their viewpoints while flexibly adapting the protocol to suit the actual interview circumstances.

User Interviews The user interview outline consists of two parts. The first part addresses questions related to the experience with gamified digital sports apps. The questions include: (1) Have you ever tried using a digital sports gaming mobile application? If yes, please share your experience of using it. (2) Do you believe that

digital sports gaming apps can enhance your interest and engagement in the respective sport? Why? (3) What role do digital sports gaming apps play in enhancing your experience with the sport? (4) From your perspective, can digital sports gaming apps inject more fun and innovation into sports activities? (5) What are the strengths and weaknesses of the specific digital sports gaming app you have used?

User Interviews - Part 2 The second part pertains to attitudes towards gamified digital baseball design, with questions including: (1) What are your views on integrating gamified elements into digital baseball design? (2) Which gamified elements do you find most appealing and likely to keep you engaged and involved? (3) What distinctive features should be present in gamified digital baseball design? (4) In your opinion, which gamified features could most effectively encourage users to embrace and participate in baseball activities? (5) What expectations do you have for the future design of gamified digital baseball applications?

For this in-depth interview, a total of 6 participants were interviewed, including 4 males and 2 females. Each participant has experience using sports gaming apps and shared their insights on gamified digital baseball applications, discussing their usage experiences and impressions.

### *4.3. Questionnaire survey outline design*

A questionnaire survey can gather a large number of responses, thereby providing a broader data foundation and reflecting the opinions of a larger population. Through a questionnaire survey, common trends and shared perspectives can be identified, revealing the general views of the public on gamified digital baseball design. Additionally, the results of the questionnaire survey can be used to validate or support viewpoints obtained from in-depth interviews. Therefore, following the in-depth interviews, a questionnaire survey was conducted to further investigate. By combining in-depth interviews and questionnaire surveys, subjective and objective data are comprehensively collected, leading to a more comprehensive understanding of participants' attitudes, opinions, and expectations. This approach provides stronger support for the conclusions drawn from the research. The questionnaire outline is presented in Table 3.

**Table 3.** Questionnaire outline.

| variate | description | source |
|---|---|---|
| Dynamics | Do you think gamified digital baseball design can make the game of baseball more fun and engaging? | Hassan et al. [11] |
| | Are you willing to use gamified digital baseball design to enhance your baseball experience? | |
| | Do you think that incorporating gamification into digital baseball design will increase user engagement? | |
| Mechanics | Do you think adding more interaction to your game would improve the experience | Chen[12] |
| | Which of the following mechanisms do you find more appealing to you? | |
| | What features do you think the gamified digital baseball design should focus on? | |

| | | |
|---|---|---|
| Components | Which of the following gamification elements do you think makes you more eager to explore? | Werbach & Hunter [13] |

## 5.Result

### *5.1. Interview content sorting and summary*

Excerpts from interview records are shown in Table 4. Summarizing the interview contents of the 6 participants reveals that they generally believe that integrating gamified elements into digital baseball design can enhance user engagement and interest. The majority of interviewees agreed that gamified digital baseball design can make the sport more enjoyable and appealing. Interviewees emphasized the positive impact of gamified elements on their baseball experience, citing increased interactivity and challenges. They highlighted the advantages of gamified digital baseball design, such as heightened interest, motivation, and real-time feedback. Some interviewees also pointed out certain drawbacks, including in-app purchases and potential excessive focus on virtual achievements. Regarding design features, interviewees suggested various gamification elements such as achievement systems, virtual reality experiences, and personalized training to enhance user experience and engagement.

**Table 4.** interview record.

| Interviewee | Interview excerpts | Demand |
|---|---|---|
| A | I think the gamification element can make people more motivated to participate, because with the sense of achievement and the element of competition, they will be more willing to invest time and energy to play. | Dynamics |
| B | I used to play an app that had an achievement system where every time you play, you get some rewards, which makes me feel very accomplished, and it's fun to see where you are on the leaderboard and compete with your friends. | Dynamics Mechanics |
| C | Personally, I think it's a good idea, especially for people who don't know much about baseball. The gamification element can make the game more fun, not just sport, but also entertaining. | Components |
| D | I think gamified digital baseball design can encourage more people to try baseball, especially young people. Making baseball more accessible to them through gamification, and gradually developing interest, is also a good way to promote. | Dynamics |
| E | The gamification element can make training that would normally be boring fun, and I find myself more motivated to complete the training program. In addition, real-time feedback allows me to keep abreast of my progress and where I need to improve. | Dynamics |
| D | I think some apps will have some content that requires a lockout, which may deter some users. In addition, sometimes too much focus on virtual achievements can make people overlook the fun of the sport itself. | Mechanics |

### 5.2. Analysis of questionnaire survey results

The survey was conducted using random sampling and distributed through online channels. A population screening question was added to the survey's homepage: "Do you have an interest in sports?" If a user answered negatively, they were directed to the end page, thereby filtering out the target users. Over the course of one week, a total of 83 responses were collected; after eliminating invalid responses, 57 valid responses remained. Among these, 61.3% were male and 38.7% were female. This survey was based on the DMC model and investigated from three dimensions: dynamics, mechanics, and components.

The results indicate that in terms of dynamics, gamified digital baseball design is more appealing to users (mean score=3.73). Integrating gamified elements into digital baseball design enhances user engagement (mean score=3.13). The majority of users expressed their willingness to try gamified digital baseball design to enhance their baseball experience (mean score=3.28).

From the mechanics perspective, increasing interaction within the game enhances the gaming experience (mean score=2.96). 72% of the respondents find the reward mechanism most appealing, followed by victory feedback, level progression, and competition mechanism. Moreover, more users believe that gamified digital baseball design should focus on increasing the enjoyment of baseball matches and providing personalized sports experiences.

At the component level, incorporating gamified elements increases players' desire for exploration. Here is the ranked selection of elements: achievement systems and rewards, virtual reality/augmented reality experiences, real-time leaderboards and competition, unlocking new stadiums and game modes, challenge tasks and special events, social sharing and interaction, personalized training, multiplayer online battle mode.

### 5.3. Game elements refining and design model building

Based on the aforementioned analysis, we summarize and distill the digital baseball design principles based on the DMC model, as depicted in Figure 2. First, at the motivation level, the core requirement lies in the integration of gamified elements. In this phase, various game modes and high-quality visual effects should be established to attract user participation and continued use. Some users mentioned during interviews that they would like to see the incorporation of virtual reality or augmented reality technology. Furthermore, based on the survey results, a majority of users also selected this option. Thus, in the design of digital baseball, we can divide it into virtual and physical components. The game interface can be set up in a virtual presentation, while physical components such as bats, baseball gloves, etc., can be integrated with interesting design methods to incorporate more gamified elements, driving user engagement.

Next, at the mechanics level, enhancing interactive experiences for users during usage is crucial. Establishing reward mechanisms, victory mechanisms, level progression mechanisms, competition mechanisms, etc., helps create a positive feedback system for users. Corresponding to specific processes, challenges, opportunities, competitions, collaborations, resource acquisition, rewards, transactions, turns, victory states, and other processes can be established.

Finally, at the component level, optimization of gamified elements is necessary. Achievement systems and rewards garner the most user attention. Therefore, throughout

the game, dynamic feedback touchpoints should be set up to provide users with positive feedback in the form of dynamic elements such as achievements, points, badges, and leaderboards.

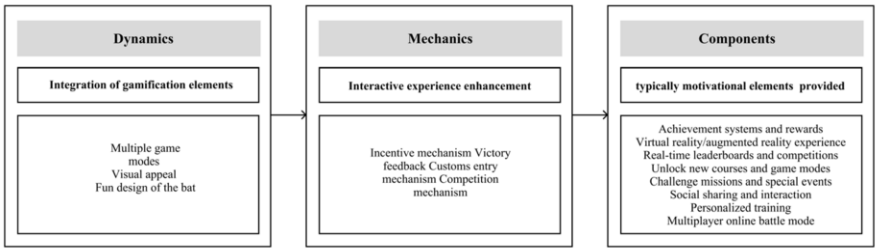


**Figure 2.** Digital baseball design principles based on DMC model.

## 6.Digital baseball game design based on DMC theory

Based on the design principles outlined above, this study embarked on the practical design of digital baseball. The design aims to offer users a novel and enriched baseball experience, thereby fostering the popularity and promotion of baseball sports. The design involves streamlining rules and operations while prioritizing user experience and entertainment value. This approach is intended to attract a wider audience to engage in baseball activities and to provide both baseball enthusiasts and the general public with a more engaging virtual experience platform.

### *6.1. Game flow design*

The initial concept of the solution was to utilize Augmented Reality (AR) technology to present this design proposal. Our idea was to center the design around hitting the ball, focusing users' attention on the hitting action itself. By simplifying rules and operations, we aimed to allow users to quickly get into the game and experience the thrill of hitting. Incorporating the concept of "everything can be hit," users could interact with everyday objects, creating more vivid and engaging situational experiences. Through AR technology, real-life spherical objects could be transformed into virtual baseballs, enabling users to interact with the virtual world within their actual surroundings, thus presenting unforeseen impacts on the real world through virtual effects. Simultaneously, the design incorporated gamified scenes and visual presentations to provide users with an immersive experience. By combining visual and sound effects technology, we aimed to further enhance users' sense of engagement and the experience of hitting the baseball. The application of haptic feedback technology allowed users to more realistically sense the force and impact of hitting the ball, enhancing their perception of the moment of impact. Refer to Figures 3 and 4 for visuals.

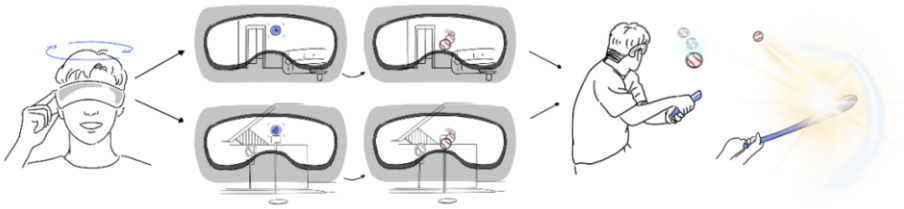

**Figure 3.** Idea of combining augmented reality.

**Figure 4.** Concept of everything can be hit.

Finally, considering that the original intention of the design was to enhance the accessibility of baseball, and the issue of high equipment costs and barriers to entry remained with AR glasses and digital baseball bats, we decided to eliminate the use of AR glasses. Instead, we opted for a digital screen to serve as the medium for the digital baseball experience, with third-party hardware providers fulfilling the screen's hardware requirements. This change ensured the realism of hitting while aligning with the goal of popularizing baseball, and it freed players from the constraints of AR glasses when experiencing digital baseball. Simultaneously, to maintain the concept of "everything can be hit" and to infuse a sense of daily life into "baseball," we ultimately settled on a variety of selectable game scenarios. Additionally, for a sports game with broad accessibility, the successful hitting detection range should be expanded. This approach is depicted in Figure 5.


**Figure 5.** Game start scene.

### *6.2. Virtual interaction design*

In order to engage users more effectively, an introductory phase was implemented before the actual experience. Prior to using the baseball bat, the entire program remains in standby mode, displaying a standby animation on the screen. Before starting to use the bat, users have the option to watch instructional videos for a trial run.

Upon entering the main experiential phase, users can enjoy two distinct hitting scenarios. These scenarios combine both three-dimensional and two-dimensional elements, aiming to provide users with a more diverse and enriched experience. Additionally, to infuse vibrancy, interest, and immersion into this phase, we deliberately designed a cute yet slightly mischievous snow monster character to guide users through the experience. This character possesses its unique appearance and abilities, such as shooting fireballs, teleporting, and creating duplicates. Players engage with the snow monster by hitting baseballs to combat it. This interaction allows users to feel a more immersive experience during the hitting process. See Figures 6 for reference.

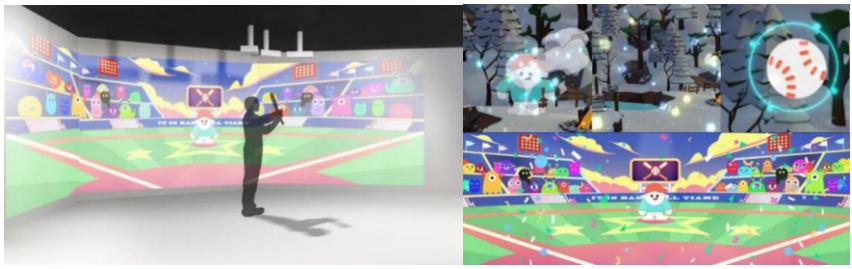

**Figure 6.** Game interactive interface.

### *6.3. Hardware interaction design*

To ensure the sensory effects of the experience, we designed a baseball bat that utilizes smartphone gyroscope technology. By installing a mobile app on the user's phone and obtaining data permissions, the app gains access to the gyroscope information and vibration capabilities of the smartphone. The position information from the gyroscope determines the virtual baseball's hit range. When a successful hit is made, the smartphone provides vibration feedback to the user, completing the interactive experience. Beyond the fundamental functions of the digital bat, the content displayed on the foldable screen can provide users with various sensory experiences, including sound, light, and vibration. By altering materials and structure and enhancing the vibrational and tactile effects, users can achieve a more realistic and immersive sensation. During the actual experience, one phone needs to be affixed as the bat, with a replaceable themed top, catering to various players' individual preferences and distinguishing the digital bat from traditional ones. Refer to Figure 7 for illustration.

**Figure 7.** Physical baseball bat design.

## 7. Conclusion and prospect

This study is based on the discussion of gamified digital baseball design, aiming to provide a more enriched and immersive experience to promote the popularity and development of baseball. The research findings indicate that integrating gamification principles with baseball sports enhances the playability and entertainment value of baseball games. By carefully balancing aspects such as gameplay mechanics, realism, and entertainment, diverse game modes, and personalized gaming experiences, more players can enjoy the fun of digital baseball gaming. In future research, further exploration can be conducted on how gamification can facilitate baseball education and training. By designing engaging and interactive baseball learning games, players' understanding of baseball rules, skills, and strategies can be deepened. Designing well-structured reward mechanisms, social features, competitions, and viewing modes can enhance participation and popularization of baseball sports. Additionally, future research could consider utilizing technologies like virtual reality (VR) or augmented reality (AR) to further enhance the digital baseball gaming experience. These technologies can provide users with a more realistic and immersive feeling, intensifying their sense of participation and immersion in baseball sports.

In summary, a user-friendly approach to digital baseball game experience design requires a balanced consideration of gameplay mechanics, realism, and entertainment, along with diverse game modes and personalized gaming experiences. This approach aims to enhance the playability and entertainment value of the game, allowing a larger number of players to enjoy the pleasures of digital baseball gaming. Future research could further explore applications in baseball education and training, as well as the potential for enhancing the gaming experience using emerging technologies.

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