Smartphone Resource Management Optimization to Improve Genshin Impact Gaming Performance in Different Configurations

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ABSTRACT
This study aims to analyze the effectiveness of smartphone resource management in improving gaming performance for Genshin Impact across different device configurations. Due to its graphical complexity, Genshin Impact often causes performance issues such as lag, throttling, and overheating—especially on mid- to low-end smartphones. Using a descriptive quantitative approach, data was collected through direct testing with monitoring tools such as PerfDog and GameBench, and supported by questionnaires distributed to 71 respondents. The results reveal that internal resource management—including RAM allocation, CPU/GPU usage, and built-in optimization features—has a significant effect on frame rate stability and thermal performance. Additionally, device specifications, in-game settings, and background app management play crucial roles in maintaining a responsive gaming experience. All research instruments were validated and found reliable. This study provides technical recommendations and ideal device configurations to help users, particularly mid-range smartphone owners, achieve smoother and more efficient Genshin Impact gameplay.

Keywords - Genshin Impact, resource management, gaming performance, device optimization

1. Introduction

The development of the digital gaming industry has shown rapid growth as smartphone users increase as the main platform for gaming. One popular game that supports multiple platforms including Android, iOS, and PC is *Genshin Impact*, which offers a cross-platform gaming experience with high graphics quality and a wide open world [1]. *Genshin Impact*'s popularity comes not only from its engaging gameplay, but also from its ability to bridge between platforms without sacrificing the user experience. However, the complexity of games like *Genshin Impact* demands high performance of hardware systems, especially on smartphones. Although various manufacturers have developed smartphones with flagship specifications such as Snapdragon 8 Gen 1 and RAM 8 GB and above, many users still report performance problems such as lag, throttling, and overheating. This suggests that high specifications alone do not guarantee optimal performance without the support of efficient resource management [2]. Poor resource management can lead to unbalanced CPU and GPU usage, excessive battery consumption, and poor temperature management. According to (Prakash et al., 2016), cooperative CPU and GPU frequency management can improve performance by up to 19% and reduce temperature variance by more than 90%. Considering the findings [1] that performance and stability are important factors in players' perception of the quality of cross-platform games such as *Genshin Impact*, it is important to evaluate the effectiveness of resource management in maintaining optimal performance across various smartphone configurations. The purpose of this study is to: (1) identify *Genshin Impact*'s performance constraints on various smartphone configurations, (2) analyze the contribution of resource management to performance stability, and (3) recommend technical approaches and ideal configurations to support a responsive and efficient gaming experience.

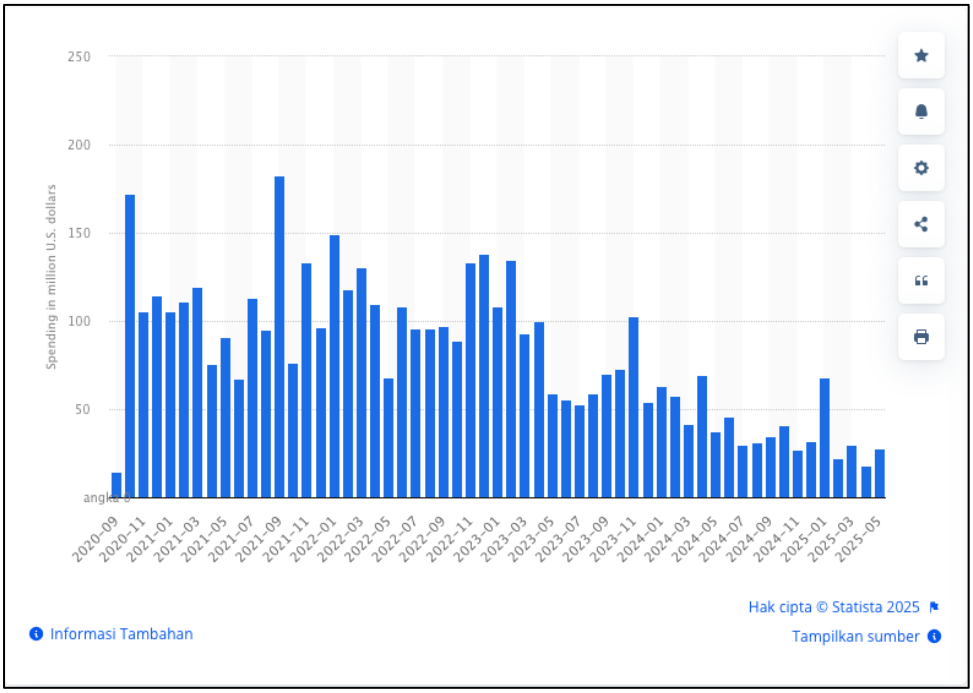

Figure 1. Statiska GI users

1.1. Problem Formulation

What are the analysis of performance constraints that often arise such as (lag, throttling, and overheating) when running the Genshin Impact App on smartphones with different specifications?

1.2. Research Objectives

This study aims to analyze performance constraints such as lag, throttling, and overheat in Genshin Impact on various smartphones, including high-spec ones. In addition, this study will analyze the efficiency of resource management (CPU, GPU, RAM, and battery) in influencing game stability and optimization, as well as identifying the most optimal smartphone configuration to run Genshin Impact stably and efficiently.

2. Research Method

The research method suitable for the title *"Optimization of Smartphone Resource Management for Improving Genshin Impact Gaming Performance in Different Configurations"* is a descriptive research method with a quantitative approach, because the purpose of this research is to analyze the obstacles that arise in smartphone resource management when running Genshin Impact games on various device configurations. The research was conducted by observing the performance of games on several types of smartphones with different specifications, then identifying obstacles such as overheating, lag, throttling, excessive CPU/GPU usage, and high battery consumption. Data is collected through hands-on testing using tools such as GameBench, PerfDog, and system monitoring applications, and reinforced with in-depth observations and interviews (if needed) to understand the technical causes of the problem. The results of the analysis are used to formulate an optimization strategy that suits the characteristics of each device.

[3] In the journal User Experience Evaluation in Genshin Impact Games using the Cognitive Walkthrough Method and Persona explains the importance of direct user experience-based evaluation to identify performance, interface, and gameplay issues on the Genshin Impact platform. It supports an observational approach and experiential analysis.

[4] in the journal Immersion in Open-World Games Based on Grounded Theory – A Case Study of Genshin Impact revealed that technical responsiveness, performance stability, and device resource management have a significant impact on player immersion in open-world games such as Genshin Impact. This reinforces the importance of quantitative observation of technical performance in an optimal gaming experience.

3. Result and Analysis

In this section, the results of the questionnaire on the distribution of respondents' age, gender, smartphone specifications, frequency of play, and the results of the Genshin Impact game performance test are displayed on several smartphones with different specifications. What was tested included FPS speed, device temperature during play, and RAM and CPU usage. The test is performed several times and averaged for more accurate results.

3.1 Age and Gender Distribution of Respondents

In this study, the majority of respondents were in the age range of 17-30 years, who are active Genshin Impact players. As many as 38% are aged 17-20 years and as many as 61.9% are aged 21-30 years. This shows that the majority of Genshin Impact players are at a productive age and are quite familiar with technology and games like Genshin Impact. [5] in their study entitled To Whale or Not to Whale: Repeated Purchase Behavior Paid Players in Genshin Impact explains that the majority of Genshin Impact players are in the young and productive age range, which is between 18–30 years old, and shows that gaming preferences and behaviors are closely related to active gaming spending and habits.

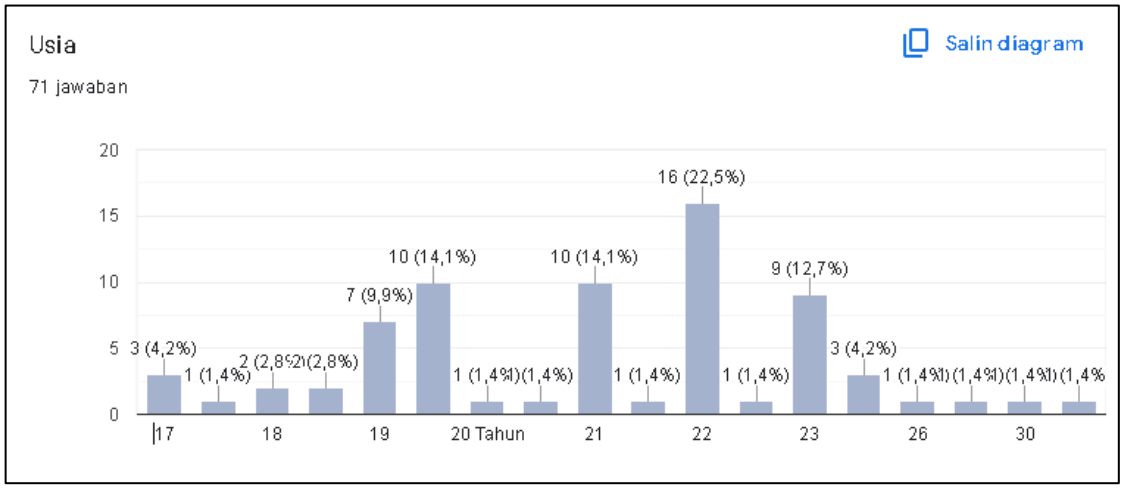

Figure 2. Age Distribution

From the results of the research as many as 71 respondents, as many as 74.6% were women and 25.4% were men. This shows that Genshin Impact players are more played by women in this study. Nevertheless, both men and women have shown interest in optimizing device performance when playing Genshin Impact. [6] in the Social Opportunities and Digitalized Communication of Genshin Impact Players study highlights that the Genshin player community in the Philippines is made up of diverse age groups, with active involvement on digital platforms and online games. This shows that social factors and digital convenience also play a big role in expanding the demographic of these game players, including women.

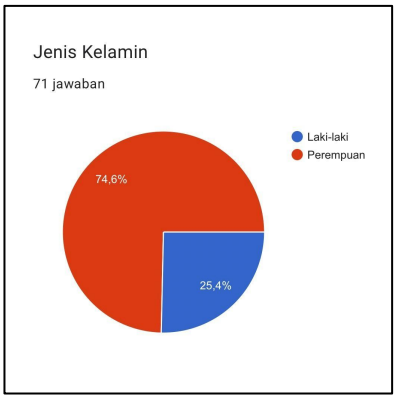

Figure 3. Gender Distribution

3.2 Smartphone Specifications

In this study, respondents were grouped based on the specifications of the smartphones used, especially in terms of RAM capacity. The results of the classification show that:

Smartphone Specifications	RAM criteria	Number of Respondents
Low-end	RAM <4GB-4GB	15
Mid-end	6-8GB RAM	34
High-end	RAM >8GB	22

This data shows that the majority of Genshin Impact players use mid-end devices, which are generally quite optimal for running Genshin Impact games with medium to high graphics. However, there are players with low-end devices, which allows them to adjust the graphics or game settings so that they do not experience freeze, throttling, or lag when playing. Research related to mobile game performance shows that adequate RAM capacity greatly affects gameplay quality, especially in reducing stutter, lag, and speeding up complex loading scenes [7]

3.3 Frequency of Playing Genshin Impact

The frequency of the respondents' play varied quite a bit. As many as 62% play almost every day, 21.1% play 1-2 times a week, 12.7% play 3-5 times a week, and 4.6% rarely play. The more they play, the more likely they are to optimize their devices, both through graphics settings and RAM management. Research by Manandhar & Timalsena (2023) on 400 students in the Kathmandu Valley showed that the frequency of playing online games had an effect, although relatively small, on academic performance [8] Although the contexts differed, these findings are conceptually relevant because the intensity of play correlates with increased attention to the quality of the gaming experience, including device optimization.

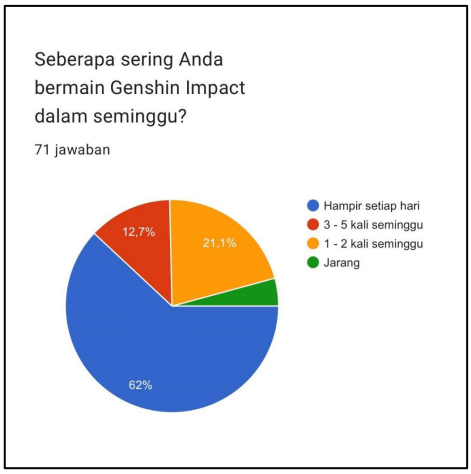

Figure 4. Frequency of GI Play

3.4 Perception of Processor Power

Based on the results of a questionnaire of 71 respondents, the perception of the adequacy of their smartphone processor specifications to play Genshin Impact is at a fairly high level. 50.7% of respondents chose a scale of 4 and 29.6% chose a scale of 5, indicating that most felt their devices were capable of handling the processing needs of these games. Only a small percentage of respondents felt that their processor specifications were inadequate, namely 7% chose scale 1, 8.5% scale 2, and 4.2% scale 3.

This data reinforces previous findings that the majority of players use mid-to-high-end smartphones, which are generally equipped with processors that are good enough to handle the graphics and system workloads of the Genshin Impact game. However, optimizing the use of the processor is still important to keep the game performance stable, especially during long gaming sessions. Research [9] (MDPI, open access) Show technique pengelolaan thermal yang efficient with Pengaturan CPU–GPU Coordinated can Increase performance gaming on Android by ≈19%, at once mengurangi variasi suhu hingga >90% .

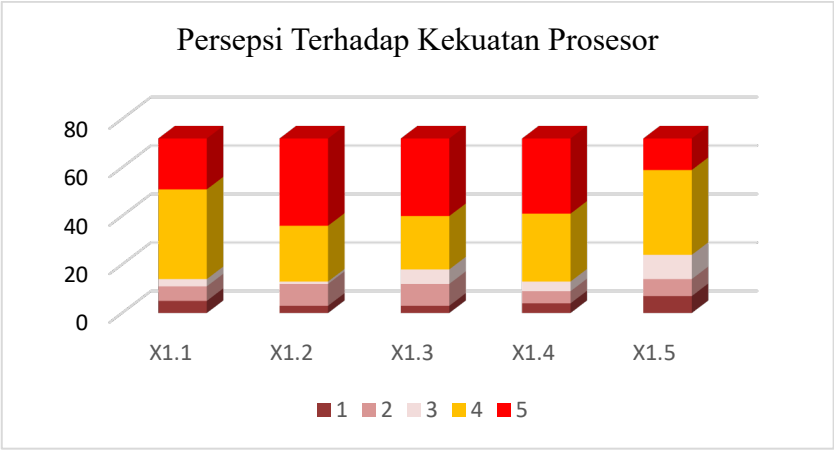

Figure 5. Research on the perception of processor power

3.5 Optimization of Internal Device Performance

In the aspect of Internal Device Performance Optimization, it shows that the majority of respondents give a high assessment of the performance of the internal devices used. 45% of respondents indicated that their built-in devices were quite optimal in supporting application usage activities (score 4), while 30% of respondents rated them very well (score 5), indicating that most were maximizing all

supporting features for an optimal experience of internal device performance with high graphics settings without lag.

However, there are around 10% of respondents who give low scores (scores of 1 and 2) which shows that there are still users who do not pay attention to the device which is likely to cause lag or performance interruptions when playing. Android Authority (2021) states that Genshin Impact is one of the mobile games with high graphics and processor requirements, so device optimization through internal features is necessary to get a smooth and stable gaming experience.

A study by [10] that evaluated mobile app optimization techniques based on Unity showed that system-level optimizations—such as model polygon reduction, object pooling, and rendering efficiency—can increase FPS and lower memory usage and CPU/GPU load on 3D games on Android devices. In addition, research from Polibatam [11] using Unity Profiler found that without optimization, mobile game FPS can be hampered in the range of 15–20 FPS, well below the ideal target of 60 FPS, thus underscoring the importance of internal optimization to maintain high performance [11]

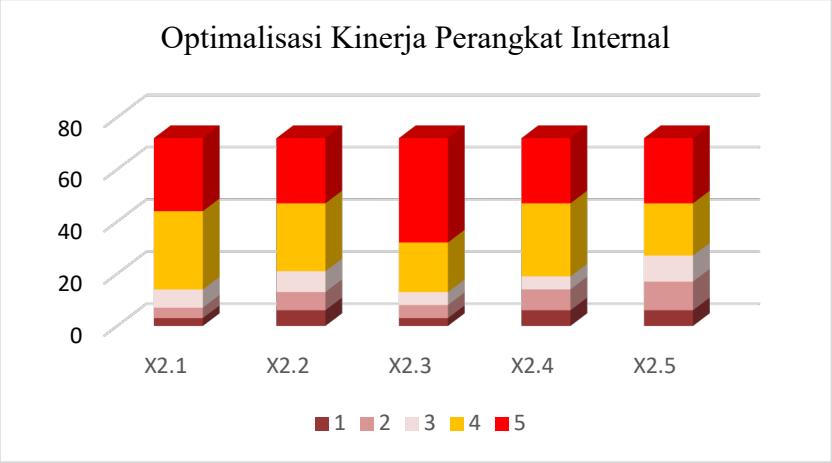

Figure 6. Internal device Performance Research

3.6 Genshin Impact Gameplay Settings

Each version shows a similar pattern of tiers: the top (rating 5, red) and rating 4 (yellow) dominate, followed by a few neutral ratings (3, light gray), and even fewer dissatisfied (1–2, brown & light orange). This illustrates that most players feel that the default or provided settings are running very well and enjoyably.

Research by [12] that analyzed the user experience of Spiral Abyss content in Genshin Impact concluded that end-game experiences, especially in terms of immersion, competence, and challenge, have a high score (2.5–2.8 on a scale of 4). These results show that Genshin Impact's default game settings and system are generally capable of providing technical satisfaction and a positive gaming experience, especially in terms of comfort and balanced challenge.

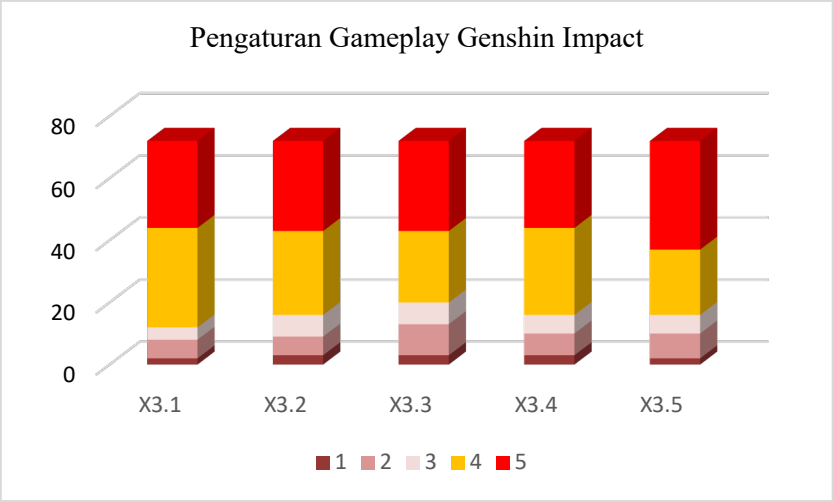

Figure 7. Research on GI Gameplay settings

3.7 Performa Gaming Genshin Impact

The Genshin Impact Gaming Performance variable shows that user perception of the performance of the current Genshin Impact game is often played on smartphones. This chart is divided into five time categories (Y1 to Y5) that depict performance trends over a specific period such as annual or different versions of the operating system. From this visualization, it can be seen that the majority of respondents gave high ratings (categories 4 and 5), which shows that in general, the performance of Genshin Impact games is considered **stable, responsive, and satisfactory** by users. Although there was little perception of neutral or negative (categories 1–3), the number was much smaller than the positive assessment.

Research by [13] in the journal The Game Online Genshin Impact as an Intercultural Communication Media noted that cross-cultural user interaction in Genshin Impact runs smoothly and effectively, which shows that the technical performance and gameplay quality are good enough to allow communication and collaboration without technical barriers. This supports the argument that positive user perception is not only about graphic aesthetics, but also includes technical aspects that are important to maintain the quality of communication and the gaming experience.

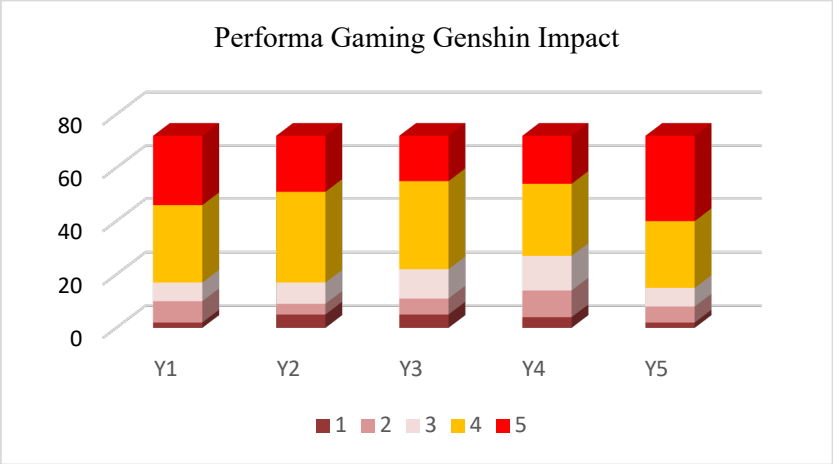

Figure 8. Performa Gaming GI

The user ratings in this graph are relevant to assessing how optimally Genshin Impact operates on their devices — including aspects of frame rate, loading time, and *thermal throttling*. This is in line with *the User Experience (UX)* theory which states that technical performance is part of the quality of user perception of an application [8].

3.8 Validity Test

In general**,** The Validity Test is carried out to check whether the questions in the questionnaire distributed to the respondents are correct in measuring what they want to research or not. So, if the question can show something that is in accordance with the purpose of the research, it means that this questionnaire is valid.

The validity test in this study was carried out using an application **SmartPls.** One of the indicators that is checked first is **nilai AVE (Average Variance Extracted)**. This value shows how much an indicator in a variable can explain the overall construct [14], a good AVE value is minimal **0,50**.

Variabel	AVE Value
X1	0,747
X2	0,528
X3	0,563
And	0.664

Table 1. Average Variance Extracted (AVE)

From the table above, it can be seen that the AVE value is above 0.50. This means that the four variables in this study already have good construct validity.

Furthermore, Outer loading shows how close the indicator is to its variable, if the value above 0.70 is considered valid [15].

Variabel	Simbol	Outer Loading Value
X1 Smartphone Hardware Configuration	X1.1	0,932
	X1.2	0,857
	X1.3	0,858
	X1.4	0,864
	X1.5	0,804
X2 Internal Resource Management	X2.1	0,745
	X2.2	0,704
	X2.3	0,617
	X2.4	0,752
	X2.5	0,800
X3 Genshin Impact In-Game Setup	X3.1	0,701
	X3.2	0,774
	X3.3	0,708
	X3.4	0,791
	X3.5	0,774
Y Performa Gaming Genshin Impact	Y1	0,817
	Y2	0,836
	Y3	0,768

	Y4	0,794
	Y5	0,866

Table 2. Validity Test Results

3.9 Reliability Test

In this Reliability Test the author uses Cronbath's technique to test reliability to describe one of the most significant properties of a single test value in a consistent manner (Rbel, 1986:71). The decision-making criterion related to the reliability test according to Ghozali (2018:46) is that if Cronbach's Alpha coefficient is >, then the variable is declared reliable. From the statement of Ghozali (2018:46), it can be concluded that all the variables studied are valid, this is due to the percentage of reliability that is above 0.7. [16] shows that Cronbach's high Alpha is also related to the statistical power in the research instrument, so that a value above 0.7 strengthens the validity and generalization of the findings

Variabel	Cronbach's Alpha
X1	0,914
X2	0,775
X3	0,810
And	0,873

Table 3. Reliability Test Results

From the table above, it is stated that Cronbach's Alpha value is more than 0.7 which can be concluded that all variables in this study are reliable.

4. Conclusion

After data collection and analysis, the conclusions that can be drawn are:

1. The main performance constraints that Genshin Impact players experience most often are lag, overheating, and throttling, especially when the game is running in high graphics settings and the playing time is quite long.
2. Users of low-end smartphones (< 4 GB of RAM) experience a fairly drastic decrease in frame rate (FPS) and a faster increase in device temperature. Games often lag and break if graphics settings are not done manually.
3. Mid-end users (6–8 GB of RAM) are able to run games relatively stably, but still experience temperature increases and high CPU consumption if they don't restrict background apps or perform power-saving mode.
4. High-end smartphones (8 GB of RAM >) are indeed superior in terms of performance, but they can still experience thermal throttling if ventilation is not good or default system settings are left unchecked.
5. The test results show that internal resource management (X2) such as background app settings, gaming modes, and power management have a significant influence on game performance, even on high-spec smartphones.
6. Based on the validity and reliability test, all instruments in this study were valid and reliable, as evidenced by the AVE value of > 0.5, outer loading > 0.7, and Cronbach's Alpha > 0.7.
7. Optimizations such as adjusting graphics, disabling background apps, cleaning RAM, and using the built-in game modes of each smartphone brand have been proven to increase FPS and lower the temperature of the device while playing.

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