Design and Development of Espresso-Based Drink Brewing Simulation Game

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Abstract— Coffee has become a common and popular beverage worldwide and in Indonesia. Coffee production and consumption in Indonesia continue to rise. Espresso is a category of coffee beverage with significant cultural and industrial potential. Unfortunately, the knowledge and familiarity are lacking among the general public regarding espresso and the different types of drinks made using espresso. Drinks such as latte, cappuccino, and mocha are not widely known in terms of their preparation and ingredients. Cup-o-caf is a serious game designed to introduce various espresso-based drinks to players. This coffee shop-themed game simulates the brewing of several espresso-based beverages. The development of Cup-o-caf utilized the Rapid Application Development (RAD) method, which involves rapid iterative prototyping. Cup-o-caf was developed using Unity Engine. The completed game was tested by conducting interviews with select individuals from Indonesia. The test results revealed the effectiveness of the game in introducing various espresso-based drinks. This research indicates that the development of a game focused on introducing espresso-based drinks, emphasizing espresso as the main ingredient, and highlighting the differences in ingredients among recipes, is a promising approach to familiarizing people with espresso-based coffee beverage varieties. Future research should consider targeting more specific tester groups, increasing the sample size, and involving experts in the game development process.

Keywords— espresso, coffee, game development, introductory

I. INTRODUCTION

Coffee is an important commodity in Indonesia. According to the coffee production report from the International Coffee Organization and the Global Agriculture Information Network, Indonesia is the fourth largest exporter of coffee in the world [1][2]. In addition to exports, the coffee produced in Indonesia is also consumed domestically, within the Indonesian coffee beverage market [3]. The Global Agriculture Information Network reports that coffee consumption in Indonesia has increased from 199.2 million kg in 2016 to 285 million kg in 2021. Based on this data, it can be concluded that coffee consumption in Indonesia has increased by 43% over a period of 5 years [3][4].

Coffee is a beverage made from roasted seeds of the Coffea plant. The Coffea plant is native to tropical regions in Africa. Nowadays, Coffea plants are cultivated worldwide for processing and consumption as coffee. Before the beans are ready for consumption, the seeds of the Coffea plant need to be removed from the fruit and dried before being roasted. Roasted coffee seeds, otherwise known as coffee beans can be packaged for processing in factories or

coffee shops. The resulting roasted beans are ground into coffee powder and brewed into a cup of coffee, to be served and enjoyed [5].

The caffeine content in coffee can enhance physical performance and alertness, reduce fatigue and drowsiness, and strengthen short-term memory [6].

Coffee beverages have become part of the social culture in Indonesia, served to guests like tea and accompanying conversations. Espresso-based coffee drinks have the potential to become part of the new generation's social culture. By introducing and educating people about these types of beverages, the general public can learn to value and appreciate drinks that are commonly seen as expensive.

Espresso is a brewing method and a type of coffee beverage produced with the same name. Espresso is made by forcing hot water through finely-ground coffee beans. The result is a concentrated coffee with a strong flavor and a thick, smooth, and creamy texture [7].

There are several noteworthy espresso drinks, such as single-shot espresso, cafe latte, cappuccino, macchiato, and mocha. Each of these drinks is made using single-shot espresso as the base ingredient, mixed and brewed with unique ingredients [8].

Espresso-based coffee drinks have gained popularity with the rise of contemporary coffee shops in Indonesia. With the development of the Indonesian coffee shop industry, espresso has become an important product in the beverage industry. The establishment of coffee shops and the serving of espresso drinks have created numerous business opportunities and new jobs in Indonesia.

The production of espresso-based beverages requires a complex process, it requires a standard fundamental knowledge to prepare these drinks professionally or personally. There is a lack of knowledge regarding espresso-based coffee beverages among the general public in Indonesia. Therefore, there is a need for a medium to teach and spread knowledge about espresso and the various drinks that use espresso as their base ingredient. From this point on, the term "espresso-based coffee beverages" will be shortened to "espresso drinks."

This research aims to design and develop a serious game as a medium for teaching various types of espresso beverages, which helps players identify and understand the differences between each espresso beverage. Through interactive visualization, it is expected that players can quickly learn about various types of espresso-based beverages.

According to Susi, serious games are designed with the intent of educating rather than entertaining. Games are fundamentally digital entertainment that can entertain and be enjoyed, but the primary purpose of creating a serious game is not for entertainment but for education or training [9][10].

Serious games can fulfill various types of activities and needs beyond entertainment, such as training, learning, and skill development. Serious games can be used as a safe learning tool, free from the risks of injury or damage. In a training setting, participants can play a serious game to learn aspects related to the skills being taught [11].

Van Gaalen mentions that edutainment and e-learning are two broader and distinct fields compared to serious games [11]. Edutainment refers to learning that utilizes entertaining media such as images, videos, and games with embedded educational elements. E-learning is a field of learning enriched using computers and interactive technology. There are several edutainment and e-learning games available that teach various subjects ranging from school subjects to job training [12][13].

A game engine is software designed as a development environment for creating interactive digital content such as video games, product showcases, and more. The game engine provides tools and technologies required by developers to build and run interactive experiences or video games [14].

Game engines usually include a set of subsystems that handle various aspects of video game development, such as rendering, physics simulation, sound, networking, and more. The collection of subsystems within a game engine allows developers to focus more on game design and development [15].

Unity is a game engine developed by Unity Technologies. According to Hocking, Unity offers a wide range of capabilities and flexibility to create both 2D and 3D games for various operating systems and platforms, including mobile, PC, Mac, and consoles [16]. The programming language used as the base for programming in Unity is C# [17]. Unity also provides documentation and various services such as the asset store, which offers ready-to-use game assets such as 3D models, audio, UI elements, and more [18].

Rapid Application Development (RAD) is a software development method that shortens the linear development cycle of analysis, design, construction, and testing into a shorter and iterative development cycle by creating various prototypes and involving users. Rapid Application Development consists of the requirements planning phase, the iterative prototype development cycle phase that involves creating varying prototypes and gathering user feedback, and the implementation phase [19][20].

There are similar research in the development of coffee or espresso-themed games like "Perancangan Aplikasi Game Edukasi Meracik Berbagai Varian Kopi 'Si Barista'" by Nico Dimas Pribadi (2021) and "Aplikasi Game Bergerak Pembelajaran Meracik Varian Kopi" by Ridwan Budiman (2017). Budiman discusses various types of coffee beans and the use of espresso machines, while Pribadi focuses on brewing different types of coffee [21][22].

This research is conducted to design and develop a game that introduces espresso-based beverage types and to determine the usefulness of games in introducing espresso-based beverages.

II. METHOD

A. DATA ACQUISITION

This research will utilize interviews to obtain data from Primary Data Sources. Interviews will be conducted using questions related to the test values measured in this study. The interview outcomes will be recorded and processed into written transcripts.

Data from Secondary Data Sources will be acquired through libraries, repositories, or other literacy portals with topic limitations that are relevant to the research.

B. DEVELOPMENT

The method used for the design and development of the game in this research is Rapid Application Development (RAD).

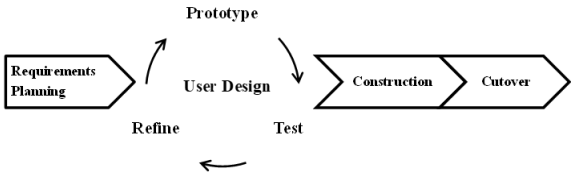

Image 1. Rapid Application Development Flow

C. TESTING

This research utilizes a qualitative descriptive analysis method. This method involves collecting data through interviews and subsequently analyzing the data. Based on the data analysis, the researcher can draw descriptive conclusions. The variables used to measure the usefulness of the developed game are benefits, interface, ease of use, and satisfaction.

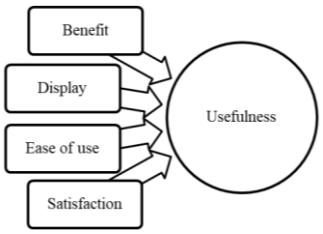

Image 1. Research Variable Relationship

III. RESULTS AND DISCUSSION

A. DESIGN

The game utilizes a point-and-click gameplay concept, while the main mechanism of the game revolves around managing raw materials to create espresso beverages. Players will interact with the

game interface to bring up a cup and mix various ingredients to create unique espresso drinks. Players can interact with special tools that provide specific raw materials to be added to the cup for mixing and brewing. Once the desired mixture is made, players can serve it to customers.

In the game design process, sketches are created to facilitate visualization and provide a glimpse of the final vision of the game. From these sketches, developers can build levels with layouts and visual elements that were created during the sketching phase.

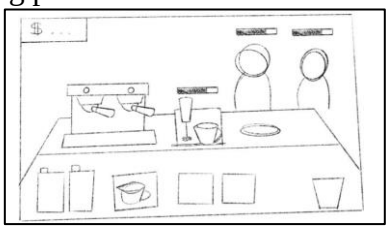

Image 2. Gameplay Sketch

The design phase also includes creating a flowchart to provide a basic overview of the game's main logic flow. The game starts by loading level data, which includes drink variations, tool options, winning criteria, and level duration. If the player has not previously won the level, a tutorial will be initiated. The level begins by initializing the level timer, representing the time limit for the level. The game loop starts, checking if there is any remaining game time. If so, an order is created, and the player is given a chance to try to fulfill it. If the order is fulfilled, the count of fulfilled orders increments. The game then checks if the winning criteria are met, changing the level status to a win status. If not, the loop starts again. When there is no more game time left, the level is declared as a loss. The level ends regardless of winning or losing condition.

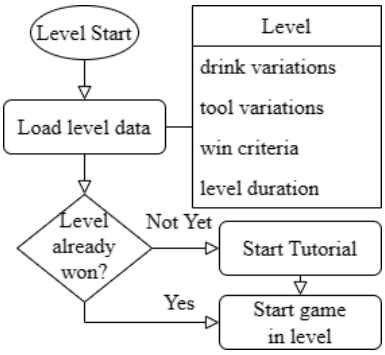

Image 4. Level Initialization Flowchart

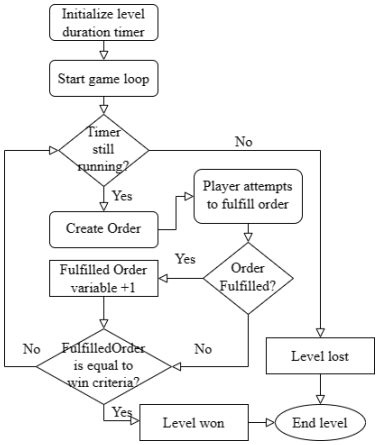

Image 5. Game Loop Flowchart

The game requires various sprites, including an espresso machine, a milk carton, a milk frother, and a chocolate powder box. To assist players in identifying different drinks, pre-made drink sprites are created and displayed in the in-game recipe book.

Image 6. Drink Result Sprites

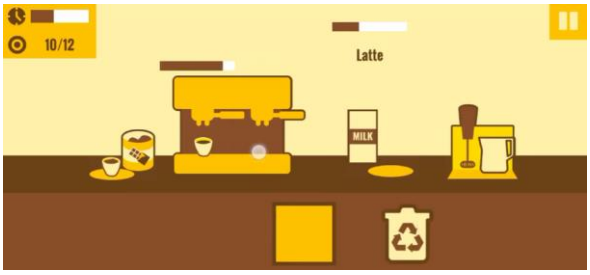

Image 7. Gameplay Display

B. TESTING

From the interviews, the researcher discovered specific insights for each variable:

1. Benefit

During the interviews, most participants agreed that the research game provided benefits and helped them learn about various types of espresso drinks. The use of recipes or recipe books within the game was identified as the most beneficial aspect by many respondents. Baristas mentioned that the sequential process of making different drinks was valuable in teaching the differences between espresso variations.

2. Visual

Many participants highly appreciated the visual aspect of the game, with responses such as "visually appealing" and "well-designed." Simplicity, coffee-related color choices, and the depiction of the resulting drinks also received praise. However, some participants expressed concerns about monotonous visual design or a lack of clarity in the use of interface elements. Although the visual presentation was considered a factor in maintaining player interest, some participants believed it did not significantly impact their interest and suggested potential improvements such as implementing 3D visuals or adding animations.

3. Ease of use

User-friendliness and usability are important for user adoption of a system or application. Many research participants did not experience significant issues with game navigation and interface; they found it clear and easy to use. However, some participants expressed concerns about unclear labeling and interactions, as well as less intuitive tutorials. This feedback provides valuable input for improving the game's interface design. Overall, the game received positive feedback regarding ease of use, with suggestions for enhancing the user experience.

4. Satisfaction from challenges

Challenges in the game provided satisfaction and enjoyment for players. Most participants in this research felt that the challenges in the game were enjoyable and motivated them to continue playing. However, some participants expressed disappointment with sudden difficulty spikes, while others felt that the challenges lacked variety and failed to capture their interest. Balancing difficulty progression and including diverse challenges is important for an engaging gameplay experience.

IV. CONCLUSION

The results of the game design and development, which have been tested, provide insights that are sufficient to draw several conclusions:

- The game Cup-o-Caf' can help individuals differentiate between various types of espresso-based drinks. During the testing phase, participants expressed that playing the game Cup-o-Caf' improved their understanding of different types of espresso drinks. As players during the testing, they were able to interact with the game, which provided a simulation of making espresso-based drinks. Players got to know various ingredients and tools used in the preparation of drinks such as espresso, latte, macchiato, and others. Each type of espresso drink had a unique recipe and appearance. From the game testing results, several concepts from the design proved suitable for learning. However, there were some concepts taken from the design that were less suitable
- The game Cup-o-Caf' successfully simulated various scenarios of making espresso-based drinks. With a variety of scenarios presented in each level, players could learn the steps involved in making each type of espresso drink available in the game. Thus, players gained an understanding of the steps to follow in preparing espresso drinks. In addition to direct interaction with the gameplay of Cup-o-Caf', players also had direct exposure to the visualization of the resulting espresso-based drinks. The visual aspect of the game helped players

differentiate between espresso drinks not only through the flow and composition but also through their appearance.

- From the testing results, Cup-o-Caf' proved to be useful in introducing various types of espresso-based drinks to players. Through the presented interactive gameplay, the game introduced and taught players about the different types of espresso drinks. Through interviews, the researcher found that the aspects of benefit, visual appeal, ease of use, and enjoyment of challenges influenced the level of usefulness of the game. The interview results with players who tested the game supported these conclusions.

The created game proved to be helpful for the community to learn and understand various types of espresso-based drinks. Through the research game, players gained an understanding of the visualization, the process of making, and the composition of the ingredients for each type of espresso drink.

It can also be concluded that the Rapid Application Development methodology is an effective method for designing and building the game in this research, allowing for a quick development timeline. Development using iterative prototyping helped identify interaction issues within the game quickly. The role of player testing was also important in ensuring that the game met the criteria and could be enjoyed without being hindered by the nature of the game as a serious game.

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