ITEM SHOP TYCOON: A BUSINESS SIMULATION GAME USING MONTE CARLO ALGORITHM

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ABSTRACT

The business simulation (also called economic simulation) genre has been around since 1983, with early titles such as M.U.L.E and Oil Barons being the first to exhibit gameplay mechanics such as the implementation of supply and demand. The genre's rise in popularity led to the production of well received titles such as Rollercoaster Tycoon, Anno 1602 and SimCity. Item Shop Tycoon is a business simulation game that puts you in the shoes of Pedro Buenaventura, a business owner who crashed his family's business after a string of incompetent and questionable decisions. He receives a second chance when a goddess reincarnated him into a new world with a shop to run. It is now up to the player to lead the shop's path to success using investments, good managing skills and a little bit of luck. The gameplay consists of point-and-click segments where the user would have to simply click certain elements in the game in order to interact. The game progresses each day of the month and ends when the day of the deadline arrives. One of the game's core features is the ability for the player to invest in various business and opportunities that allows them to gain return of investment after a specific amount of time with bonuses such as special item that could delay the time, attract more customers, or discounts on certain items. This depends on the amount invested. However, these present various amounts of risks because these businesses and enterprises can fail. The Iterative Development Model is used for this project since it is focused on simplified implementation that repeats some tasks to improve and polish the result.

KEYWORDS – Business Simulation Game, Monte Carlo Simulation, Game Development

INTRODUCTION

Item Shop Tycoon is a business simulation game made to give an idea of how running a business and investing in other businesses work. This is done through mechanics that allow the player to make decisions similar to how one would when running an actual business while making it engaging and enjoyable. The game is made with simplicity in mind. This is the case because the gameplay consists of point-and-click segments where the user would have to simply click certain elements in the game in order to interact with it. The game progresses each day of the month and ends when the day of the deadline arrives, which is the end of said month. The player must accumulate enough gold before the deadline or fail the game and start over. Business-related mishaps such as investments failing can happen at random. This will test the user's ability to respond to these situations. But this doesn't mean that only misfortune is to be expected throughout the player's journey, random events that favor the player can also occur. These come in the form of increased demand for certain types of items, this allows the player to increase prices significantly for more profits, and investment bonuses.

The business simulation (also called economic simulation) genre has been around since 1983, with early titles such as M.U.L.E and Oil Barons being the first to exhibit gameplay mechanics such as the implementation of supply and demand, that would eventually inspire other titles such Rollercoaster Tycoon, Anno 1602, SimCity and Open TTD to name a few. The genre became much more prevalent with the rise of smartphones. Titles such as Game Dev Story, Star Traders and Transport Tycoon rose to popularity and made the genre more accessible and enjoyable for everyone.

The proponents' target audience are teenagers from 13 up to 21 years of age. This is the case because this age group can better enjoy and appreciate what Item Shop Tycoon has to offer because they are at the age where they can grasp basic concepts of financial investments and entrepreneurship.

The game is a 2D game that features a character design similar to that of Japanese Role-Playing Games (or JRPGs) in which most of the characters in-game are shown in short and very appealing forms. This is alternatively called "chibi", a slang Japanese term to describe something short. It also includes a colorful and detailed background. The game allows the player to take on the role of running an actual shop that involves managing prices, stock, and customer needs in a small compact environment that has events and opportunities like a real shop would have.

LITERATURE REVIEW

Local Literature

Roxas Night Market (J. L. Cordova, 2017)

In this game, the mayor of Davao City has assigned the player the task of making Roxas Avenue, a place that is nothing more than a passageway for cars, jeepneys, motorcycles and other vehicles, into a successful marketplace that will attract locals and tourists. It is up to the player to manage the stores and resources available to turn Roxas Avenue into the Roxas Night Market [1]. This game is a business simulator that was one of the inspirations for Item Shop Tycoon. It is a game that is simple and easy to understand. You put up various kinds of shops such as an Isaw store, a Kwek-kwek stall, and an ice cream stand. These shops can be upgraded in order to attract more customers, be able to hold more stock, or decrease the amount of time spent providing the goods to the customers.

Millennials are changing the game in the Philippine Stock Exchange (D. J. Magturo, 2017)

The article explains that there has been a rise of young men and women that are investing in the stock market, a place that is commonly dominated by older men and women in their late 20s and above. The rapid rise of technology has also been a significant factor of this trend. Jose T. Pardo, the chairman of the Philippine Stock Exchange, has stated that the PSE has joined the digital age and that these young people or millennials, well-versed in the workings of current technology, are quick to adapt so they are now seeing a surge of these people investing their money in the stock market [2].

While investing is not only limited to the stock market, the article does indicate that young people are now interested in investing their money into various ventures. This shows that a game such as Item Shop Tycoon can make a significant impact in further increasing the number of young investors as well as promote good financial habits such as saving and wise spending when done right.

Foreign Literature

Merchant (Retora Game Studios, 2018)

Merchant is a business simulation game developed by Retora Game Studios. It puts the player in the shoes of a shopkeeper who manages heroes and crafters. Heroes are people with combat experience that the player can hire in order to get raw materials from dangerous places and crafters are in charge of making products such as weapons and potions out of the raw materials that the player provides. The game also includes mechanics that role playing games tend to have such as leveling up and managing heroes' equipment so that they will be prepared for far more dangerous places in search of materials [3]. Merchant is available for Android, iOS and even PC. It can be downloaded for free in the Google Play Store, Apple App Store and Steam respectively.
This game shares some similarities to Item Shop Tycoon's shop management mechanics. Merchant's main gameplay of getting raw materials, crafting products out of said materials and then selling them for a profit shows that even with simple game mechanics, it can still be engaging for interested players and be very well received.

Moonlighter (Digital Sun, 2018)

Moonlighter is an action role-playing game that has the player take the role of Will, a shopkeeper that dreams to be a hero [4]. The game features two sets of activities based on the time of day. During daytime, the player is expected to sell items in his shop, this includes putting items on sale, setting appropriate prices, recruiting assistants and upgrading certain parts of the shop to increase profitability. The player can also talk to non-player characters (NPCs) scattered about the village that the protagonist resides in. Doing so can reveal quests that could earn the player beneficial rewards in order to progress further into the game's storyline as well as be able to craft and upgrade

equipment. At night, however, the player can explore gates that lead to different dungeons, facing various enemies with various strengths and weaknesses. This activity allows the player to gain loot and accomplish quests. Moonlighter's similarities to Item Shop Tycoon primarily lies on the shop keeping mechanics. Similar to the former, the latter features setting of prices and shop upgrades. However, another similarity lies in one of the notable minor features in the game that gives the player the option to invest money in the market through an in-game bank.

METHODOLOGY

The Iterative development model was used for this project because it focused on an initial simplified implementation that repeated some tasks to improve and polish the result. This allows easier testing and debugging of the software during development. The whole project is divided into separate builds and these builds can be repeated to add improvements and changes that can easily be implemented for each repeated build allowing the next result to be better than the previous one.

In order to develop the game, Unity 5.3.4 was the game engine used. Paint Tool Sai 1.2.5 was utilized in order to make the designing process much faster and simpler. The software mentioned allowed the proponents to experiment and creatively work towards the creation of the assets used in the game. These include character sprites, portraits and game locations. In order to animate the character sprites used in the game, Adobe Animate CC 2017 was used. Prototypes of the user interfaces of the game were created using Balsamiq Mockups 3.

The game's design is based on the principle that games should be simple and easy to understand in order to let the player enjoy the game without keeping in mind too many variables and underlying game mechanics. It is a fantasy video game because the proponents found that there is more creative freedom in this genre compared to a business simulation based on real life places and events. Because of this decision, the game's assets have a distinct art style that is similar to great works of fiction in the fantasy genre. So, characters come in various races such as elves and demi humans, aside from the usual human character designs. The art for the shop as well as the characters were first designed by hand and further improved through art tool programs. Improvements are then made over time depending on the direction of the development cycle. As mentioned earlier, the game is a fantasy business simulation that has embedded simplicity into its game design decisions. There is no point in doing complex game mechanics if the player base is alienated and intimidated in the process. However, this does not mean that there is a case of over simplicity in the game's mechanics. The proponents strive to find that balance between deep, meaningful gameplay and simplicity.

The player is expected to manage the shop and sell as much products as possible within an in-game day. Various customers arrive in the store with a certain item in mind but whether or not they will buy items from the player's shop is based on the customer's buy chance, a value that can be upgraded as the player progresses through the game. These characters have varying occupations and clothing that is appropriate to the setting. If a customer detects that a desired type of item is available, a stat bonus is awarded to the player. This bonus comes in the form of increased buy chance for the customer that comes in the store, a variable in the game that determines whether or not the customer will buy the item or not. This allows for variation and gives room for player choice.

Since the game's requirement is to reach a certain amount of gold before in 30 in-game days, another method can be employed by the player in order to reach the requirement amount quicker. This can be through investing in other businesses. This allows the player to provide money for other businesses in need of an investment in order to get a return, getting more gold than what was invested. However, just like in real business investments, this is not assured. There is a chance that a business might fail and only a half or a quarter of the expected return of investment may return to the player. The success rate of a business can be seen in the investment information menu, where the player can see the success rate percentage that is predicted using a Monte Carlo Algorithm.

The game uses a form of Monte Carlo algorithm in order to predict in-game investment stocks. According to an article on Palisade [5], a Monte Carlo simulation is a computerized mathematical technique that allows one to account for risk in quantitative analysis and decision making. This is commonly used in professions such as finance, manufacturing, engineering and research and development. The simulation provides the user with a range of possible outcomes and probabilities in order to help them make decisions. Which is why the proponents have found this algorithm to be quite important for the investment feature as it allows the player to make a decision whether or not they would want to invest on a particular company.

This algorithm uses a uniform distribution in order to get the returns of the investment. This is implemented into the game by first randomly generating the sales figures of a company for 10 days and using the minimum and maximum values of the data as input for the algorithm to predict the return of investment that the player might receive after a required amount of in-game time has passed.

The proponents have distributed survey questionnaires to 100 individuals, 50 of which are in the I.T sector and another 50 in the Business sector, in order to gather their views and opinions about the game through a predefined set of questions that can be answered by a rating of 1 to 5, 1 being the lowest score and 5 being the highest possible score. There is also a section in the end of the survey where respondents can put their own comments or suggestions about the game.

These survey questionnaires include questions regarding the aspects of the game such as the story, gameplay and audio. The questionnaires include five choices, displayed using numbers ranging from 1 to 5, that would allow them to express how much they agree with the question presented. Below are the choices that the respondents can choose from.

5 – Strongly agree
4 – Moderately Agree
3 – Agree
2 – Disagree
1 – Strongly Disagree

RESULTS

Table 1. Story and Game Objectives

Criterion	5	4	3	2	1	Total
1.1 Story is clear and straightforward	28	32	4			64
1.2 Game objectives are explained in a clear manner	29	24	11			64
1.3 The story and game objectives provide a good player experience	26	32	6			64
1.4 The story is presented in a simple and understandable manner.	28	29	7			64

Table 2. Visual Elements

Criterion	5	4	3	2	1	Total
2.1 Characters are visually pleasing	41	15	8			64
2.2 The characters and game items are appropriate to the setting	37	22	5			64
2.3 User Interface is visually pleasing and did not get in the way of player experience	27	34	4			64

Table 3. Originality

Criterion	5	4	3	2	1	Total
3.1 I have played a game similar to this before	12	26	16	6	4	64
3.2 Game objectives are explained in a clear manner	23	29	9	2	1	64

Table 4. Audio

Criterion	5	4	3	2	1	Total
4.1 The music and sound effects are clear and understandable	28	34	2			64
4.2 The music and sound effects are appropriate for the setting and gameplay.	33	19	12			64
4.3 The audio did not hamper on the player experience.	27	31	5	1		64

Table 5. Game Playability

Criterion	5	4	3	2	1	Total
5.1 Gameplay is smooth and runs without any issues	36	22	6			64
5.2 Gameplay is fun and engaging	25	29	10			64
5.3 Features work as intended	36	28				64

Table 6. Difficulty

Criterion	5	4	3	2	1	Total
6.1 Gameplay difficulty is challenging	22	30	11	1		64
6.2 Gameplay difficulty provides a good player experience	20	32	12			64

Table 7. Features

Criterion	5	4	3	2	1	Total
7.1 Investment system is simple to understand	28	32	4			64
7.2 Investment system contributed to a good player experience	29	24	11			64
7.3 Upgrade system contributed to a good player experience	32	27	5			64

DISCUSSION

From the data presented in the results, it is clear that the game is well-received in almost all aspects. In the first table, it delves into the game's story and its objectives. The respondents found it necessary to gather data regarding the respondents' reception on the game's approach to a simpler form of storytelling through cut scenes. It is also important to explore what their opinion is regarding how the game puts emphasis on the important objectives that player must accomplish. As seen in Table 1, it is clear that the method of expressing the story to the player was well received by the respondents. It is also evident, based on the number of respondents who answered 5 and 4 in item 1.2 and 1.4 of Table 1, that objectives were explained clearly and that the story is simple for them to understand.

The second table details how Item Shop Tycoon's visual elements affected the player experience. Visual elements include the character assets, item assets and the user interface. It is clear that respondents' reception of the characters is positive and that they find them and the in-game items appropriate to the setting. The user interface was well-received as well. It is a simple and straightforward design proved to be visually pleasing and did not hamper on their experience as shown in the Item 2.3 of Table 2.

The third table delves into the originality of Item Shop Tycoon. On item 3.1, when questioned whether or not respondents have played a game similar to what they were presented, it is evident that the majority of them agree that they have played similar business simulation games before. This may prove that the genre itself has gained significant popularity.

Audio is an aspect of the game that was also well received by the respondents. In Table 4, it shows that they agree that it is both appropriate to the setting and that it was clear and audible, noting the majority who also agreed that the game's audio did not hamper on their experience with the game.

It is clear based on the gathered survey data that other aspects of the game such as playability, difficulty as well as in-game features such as the investment and upgrade system gained positive reception among the respondents.

CONCLUSIONS AND RECOMMENDATIONS

Item Shop Tycoon's main purpose is to inspire people into properly managing their financial resources and explore the idea of entrepreneurship as a potential means of achieving success. The game's positive reception among the respondents prove that business simulation games has an untapped potential to do that.

The proponents recommend that more games be developed embodying the same purpose. To further popularize the business simulation genre and inspire a generation of individuals who are financially responsible and do not shy away from the notion of exploring the opportunities that the business sector entails.

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