

ARI3216 - Web Data Mining Course Project

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Abstract. Budgeting should be a key element of day-to-day life, yet most youths do not acknowledge the importance of managing their resources and planning for the future. This project is an attempt at the gamification of budgeting education, teaching planning and resource management skills through simple game mechanics and concurrent themes without neglecting the element of fun expected from a game. By highlighting the importance of these valuable skills through both negative and positive reinforcement throughout the course of the game, it should help the player better appreciate the need to make similar considerations in their everyday life. The application of web scraping techniques to obtain relevant and updated information about average wages, maximum pension earnings and similar financial statistics will also aid in putting the real world implications of the skills highlighted in this game to perspective. Moreover, this helps the game itself remain relevant over time since such statistics would be fetched in real time as opposed to being hard coded and requiring manual updates.

Keywords: Unity Development · Web Scraping · Budgeting.

1 Introduction

1.1 Motivation

As a group of students approaching the end of our undergraduate university experience ourselves, we can personally attest to the fact that important life skills like budgeting and financial responsibility are not very well represented in the Maltese education system. For most students, this reality only truly starts coming to light in their late teens and early twenties when they are expected to begin seeking employment and experiencing their first glimpse of financial independence. The aim of this project is to shed light on these topics from a younger age in an interactive and engaging way so as to reduce the potential future confusion brought about by an overwhelming surge of new responsibilities.

1.2 Proposed Solution

The solution presented in this paper to help tackle the aforementioned problem is an infinite runner-esque style game split into levels representative of different stages of life, with simple controls for bi-directional vertical movement, aiming and shooting. The player has five attributes to manage and maximise: Income,

Knowledge, Sanity, Energy and Health. These attributes represent five important factors to balance in order to maintain a healthy lifestyle. Throughout each level, the player has to make choices in order to manage these attributes whilst also avoiding enemies representative of distractions and obstacles faced in real life. At the end of each level the player's progress is shown with respect to each attribute, with different perks being awarded to the player when they reach progress milestones for the aforementioned attributes. After this display of progress, the player is prompted with a choice which reflects the transition between different stages of life or major life choices, such as choosing whether or not to continue studying or what field of study they wish to pursue. These choices will have a fitting, significant impact on the course of the game from that point onward, helping to both highlight the effect of such choices in real life while also making the game more engaging and increasing replayability.

1.3 Objectives

Throughout the course of the game, the player should learn to adapt to in-game mechanics which represent real life decision making. A number of objectives must be tackled to truly achieve our target solution, namely:

1. Create an engaging game with an intuitive interface.
2. Present real life decisions as fun and interactive mechanics.
3. Visualise player progress to help teach meaningful and practical lessons.

1.4 Background

Through both first hand experience and various studies, it is known that Malta's educational syllabus is almost solely based on academia throughout all institutions. Inherently this is not a problem, however most young adults end up being at a loss when it is time to manage their own taxes, take up financial duties [3], long-term planning and more [4]. Research conducted by Fsadni [4] revealed that the financial decisions of most young adults were not their own. A database from 2014 shows that only 56% of people aged 15-34 reserved significant values at a financial establishment [2]. Despite this, 87% of people aged 15-24 still had bank accounts [1]. Financial concepts should be taught from a young age. Nonetheless, it is obvious that most youths are not interested in learning these notions since it does not affect them immediately.

The aforementioned research proves that this problem is very prevalent in Malta. When presenting these issues as a game, it is likely that it would be too difficult to make it entertaining for teenagers whilst keeping the educational aspect intact. However, an argument can be made that children from 9-13 would be an ideal target market. Nowadays children rely and depend on tablets to communicate and play games. Furthermore, the government is providing students with tablets for school, thus making it a perfectly viable platform. A recent blog post [5] reveals that these tablets are underused as there is lack of incentive. An affiliation could be made to introduce a series of this type of educational games

as children within this age bracket would likely be more keen to give them a shot.

1.5 Related Work

Educational games in the Maltese market are scarce. Most games are presented as board games, flash cards and toys. Currently, computer games and applications are not frequently explored in the Maltese markets, especially games targeting financial responsibility. Globally, many have tried to create educational games which manage to captivate players. In fact, the main challenge encountered when designing educational games is to make them fun and engaging without losing touch of the educational scope.

2 Business Plan and Strategy

The ultimate goal of this project is to have the finished game be played by children all around Malta. This entails that the game must either be marketed well or have some kind of public affiliation with a government entity. As previously discussed in the Background Section, Malta is currently providing tablets for school children. However, these tablets are ending up being unused [5] by both the students and teachers. If an affiliation were to be made with these entities, the game could be pre-installed on all devices and teachers could use it as a learning tool in class. In turn, this could result in both more engaging lessons for the children and a means for the teacher to begin further discussion about the topics targeted by the game. Such discussions would further ensure that the concepts presented in the game are properly grasped by the children.

3 Technological Aspect

This game was created using the Unity game engine with C# as the programming language of choice for scripts controlling the game's behaviour. This prototype includes a single level to illustrate what the game is trying to convey. Every relevant game component will be discussed in the subsections below.

3.1 Main Menu

The main menu is a simple scene comprised of the main background image of the game and two buttons. The player has the option to either Play the game or Quit. During this state, background music is being played.

3.2 Level 1: Roaming

The first level starts with the player roaming a library. Within this scene the player must decide which orbs to acquire throughout the level as each orb affects

player attributes. These orbs are 2D sprites that move towards the negative x axis. These are spawned by an invisible master object which manages all spawning throughout this scene. Orbs are randomly spawned within a redefined range in the y axis and are instantiated with a random type: Work, Study, Exercise, Energy-drink and Fast-food. Each one affects player attributes differently as shown in the table below.

This scene also includes threats to the player. The first non-playable character (NPC) is a blob-like creature representing sickness, which is deadly on contact. When this NPC is encountered, the player's health bar is turned to green as they are taking damage over time. This NPC should be dealt with quickly as once it is very damaged, it charges the player. Therefore, the earlier the player deals with it, the more time they will have to finish it off before it makes contact with them.

The second threat is a round creature with horns and fins, though these features are overshadowed by its enormous eye. The design of this creature is meant to symbolise the numerous eye-catching distractions encountered on a daily basis which can hinder your progress towards more pressing issues. This NPC is a 2D sprite and behaves similarly to the aforementioned creature, however it does not charge the player or affect them over time, and simply moves in a fixed horizontal line towards the player's side of the game world.

3.3 Level 1: The Boss

At the start of the boss level, the music shifts to a more ominous tone. Here the player is transitioned to the new scene where they encounter the boss of the first level. The UI reflects the change by introducing the boss' health bar below. It has a substantial amount of hit points and can withstand many hits. During the first phase, this NPC faces the player whilst shooting a series of projectiles at regular intervals. Once the NPC drops below half its maximum health, the second fighting phase is initiated. During phase two, the owl charges towards the negative x axis damaging anything in its path, similar to the second type of NPC encountered in the previous stage. If the player manages to defeat the boss, the first level would be completed and the following scene loads.

3.4 Progression

At the end of each level, the player with the resultant progression after the previous level. Each attribute could be leveled to unlock various feats and abilities. The upgrade path is available for the player based on the choice of orbs acquired. This is a very important component in the game as a decent progression scheme provides the player with incentive to keep on playing and to pay deeper attention to the in-game mechanics.

Once the above visualisation is completed, the player is greeted with a life choice. Each decision would impact the outcome of the following scenes and scenarios. Within the context of the first level, once the player has defeated the Spirit of Knowledge (the previous NPC), it represents the first milestone

that a Maltese student faces when completing their O-levels. Now the player can either apply for post-secondary education (being governmental, private or church schools) or begin working life with a minimum wage job. Once the decision is taken, the player is informed of the affected changes and the next level starts. It is good to note that the current interface for the progression and decision screens are merely placeholders which would be overhauled upon further development.

Currently there is no second level since we believe the first level along with the progression scene gives a suitable indication of the intended final product. However, a test scene is presented after the choice is made with the option to scrape the Maltese minimum wage from a website¹. This information is displayed to show that a connection to a custom API allowing for the scraping of relevant data from the web has already been created. For this feature to work, a python script is used to run the API server locally. In the future, this API would be deployed to the cloud or replaced with a direct C# solution for data scraping.

3.5 Player Death

In the case of player death, a new scene is displayed with the option to return to the main menu. Although it is not yet implemented since the current prototype does not include a fully functional progression system, the goal of this scene is to show the player a recap of the attributes acquired and the choices they made. For instance, based on the career path and other career related decisions chosen by the player, as well as relevant statistics scraped from the web, their wage and pension would be estimated and shown.

4 Design and Implementation

The Game is designed as a 2D shooter. All game graphics are original and crafted specifically for it. Overall progression throughout the game is tracked by the five main attributes: Income, Knowledge, Energy, Sanity and Health, which are always visible above the player's hit point bar. The player can either decide to focus on particular attributes or attempt to keep them balanced. The level of your attributes can either prevent or make it easier for the player to experience certain content in the game if they are too low or particularly high. Each attribute also has a tiered progression to it giving the player added traits when they reach different milestones. These milestones could be seen at the end of every boss battle where the user gets a rundown of how his attributes have changed from the beginning to the end of the battle. Moreover, the player can also be afflicted with temporary negative or positive effects if their attributes exceed certain thresholds throughout the course of a level. For example, if the player's energy drops to 20% during a level, their movement speed will be reduced until it exceeds this threshold again or they move on to the next level.

¹ <https://tradingeconomics.com/malta/wages>

5 Testing and Evaluation

The game was constantly being play-tested throughout the development process in order to identify the changes that need to be made in order to truly maintain the notion of an engaging and educational game-play experience. Moreover, the play-testing allows for a direct evaluation of the balance and flow of game mechanics which helps ensure that the final product gives a challenging yet balanced experience.

6 Future Development

In its current stage, the game gives a solid idea of our desired final product. The key improvements yet to be made are as follows:

1. Add more levels and all the components that come with them such as choices, enemies and bosses.
2. Give a detailed breakdown of the player's performance and the impact of their choices throughout the course of the game at the end, and highlight the correlation to real life decisions.
3. Implement the attribute based progression system which gives perks between levels based on the player's resource allocation throughout the game.
4. Enhance the real time punishment and reward system by adding a wider variety of positive and negative effects brought about by the player's resource levels during a level.
5. Add settings such as volume and key bind control.
6. Improve the UI for the progression and decision scenes to give a proper indication of how they will effect the player going forward.
7. Implement a bestiary of sorts to give further insight on the significance of the NPCs encountered throughout the game.

7 Conclusions

Ultimately, we believe that the current prototype for the game is indicative of a promising potential solution to a gap shown to be present in the Maltese education system. Given the opportunity to take it further and implement the aforementioned ideas and improvements, it could be a valuable asset in increasing the quality of education provided to Malta's youth, potentially even shedding light on the possibility of applying a similar approach to other underrepresented topics.

References

1. Malta - account at a financial institution, young adults (2014), <https://tradingeconomics.com/malta/account-at-a-financial-institution-young-adults-percent-ages-15-24-ts-wb-data.html>

2. Malta - saved at a financial institution, young adults (2014), <https://tradingeconomics.com/malta/saved-at-a-financial-institution-young-adults-percent-ages-15-34-wb-data.html>
3. Investments for millennials (2019), <https://timesofmalta.com/articles/view/investments-for-millennials.730774>
4. Costa, M.: Half of those aged 20 to 29 don't make their own financial decisions, study finds (2018), https://www.maltatoday.com.mt/news/national/91126/half_of_those_aged_20_to_29_dont_make_their_own_financial_decisions_study_finds#.Xhu9125FwUQ
5. David, H.: School tablets 'positive experience but under-utilised' nao survey finds (2019), https://www.maltatoday.com.mt/news/national/97944/school_tablets_positive_experience_but_underutilised_nao_survey_finds#.XhvHUG5FwUQ

8 Appendix

Orb Type	Income	Knowledge	Energy	Sanity	Health
Work	+5		-2	-2	
Study		+5	-2	-2	
Energy-drink	-2		+5		-2
Fast-food	-2			+5	-2
Exercise	-2		-2		+5

Table 1. Sickness NPC.



Fig. 1. Sickness NPC.



Fig. 2. Distraction NPC.



Fig. 3. Owl NPC.



Fig. 4. The game main menu.



Fig. 5. In game screen capture.

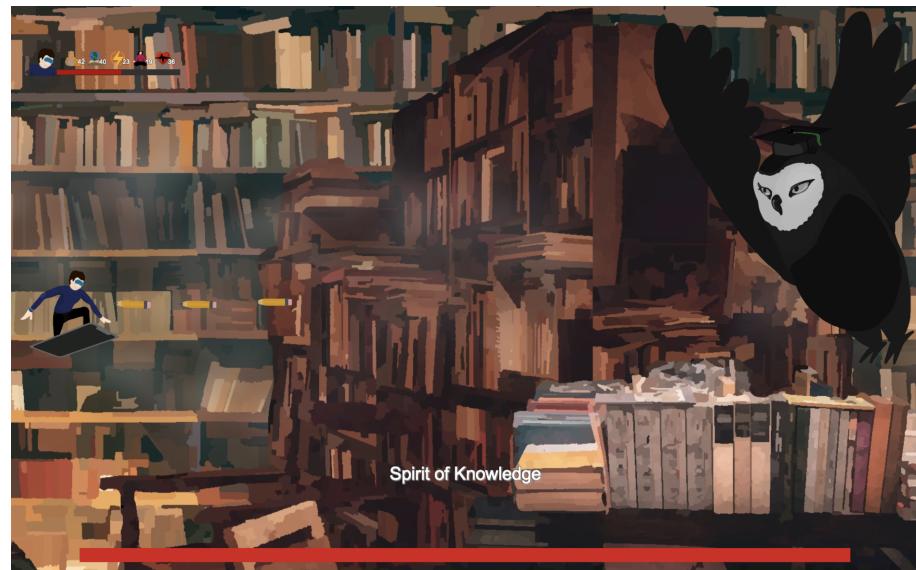


Fig. 6. A screen capture during the final boss.