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GREENPLAY

Gamified E-commerce for Sustainable Shopping Experience

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GREENPLAY- Gamified E-commerce for Sustainable Shopping Experience

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ABSTRACT

As new applications are developed, life in today's digital world gets easier all the time. In the cutthroat industry, the necessity for innovative ways to hold onto current clientele and establish market positions is growing. Gamification-infused solutions offer a smooth user experience that replicates the excitement of gaming. As a result, unique solutions like this are essential for distinguishing brands. Current e-commerce strategies can focus on sustainable solutions when choosing product lines, packaging, and delivery options, which can lower costs and preserve natural resources.

In this regard, it is critical to raise e-commerce users' understanding and promote the adoption of sustainable practices. Inspired by pre-existing frameworks and scholarly research, the gamification framework GreenPlay was created for this project. It was included into a basic e-commerce website, combining gaming objectives with sustainability initiatives to encourage users to alter their behaviour. Gamification ideas were used to integrate game dynamics in a fun way.

Keywords: Gamification, E-commerce, Sustainability, Game elements, Usability, Loyalty

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1. INTRODUCTION

1.1 Overview

The term "gamification" is becoming increasingly prevalent in our daily encounters. Although the general idea is to play games to make tedious activities funnier, actually putting this into practice is a difficult undertaking. Notably, departments like marketing have recognized its effectiveness, prompting marketing professionals to incorporate gamification extensively into their strategies.

In a world undergoing rapid digital evolution and nearing the depletion of natural resources, it becomes imperative to take preventive measures. Sustainable habits can be achieved through small changes in lifestyle and familiar adjustments. The industry plays a role in contributing to sustainability efforts by providing solutions that address such needs.

E-commerce websites are significant players in the sale of consumer products. By integrating gamification dynamics into e-commerce platforms, it may be possible to establish sustainable habits and practices, encouraging users to make environmentally conscious choices during their online shopping experiences.

1.2 Motivations

The motivation behind this study stems from the understanding of how important gamification is to maintaining customers in the online retail industry. Innovative strategies are critical in the very competitive e-commerce environment, where attracting and keeping customers is crucial.

The goal of the study is to investigate and put into practice gamification techniques that work well in this changing environment. Moreover, the study attempts to capitalise on developments in the sustainable product space as sustainability becomes more and more important in consumer choices.

By integrating e-commerce practices with the increasing awareness and concern for environmentally conscious consumer choices, this strategic alignment aims to achieve two goals. The study's purpose also stems from a strong desire to understand and impact consumer environmental behaviours, especially in the context of online buying

1.3 Aims and Objectives:

This study's main goal is to apply gamification approaches to an e-commerce website in order to increase user engagement, create a livelier and more enjoyable online buying environment, and develop long-lasting shopping habits.

One of the primary objectives of this project is to implement a gamified e-commerce website augmented with gamification features like challenges, badges, and levels. Using this practical approach, the study aims to both explore the theoretical aspects of gamification's impact on user behaviour and offer a concrete illustration of its implementation. By building an interesting online platform, it also seeks to improve consumer involvement, boost user interactions, and offer important insights about the relationship between gamification and e-commerce.

1.4 Specific Objectives

2. To develop an intuitive and user-friendly e-commerce platform as the foundation for a positive user experience, ensuring accessibility and ease of navigation.
3. To conduct academic research underpinning relative study.
4. Identify and define relevant game elements for an e-commerce platform.
5. To develop a comprehensive gamification framework tailored to the e-commerce environment, specifying desired user behaviours to build and sustain engagement.
6. To apply the designed gamification framework into the e-commerce platform (GREENPLAY) to create a gamified shopping experience that encourages sustainable and environmentally friendly consumer behaviours

2. LITERATURE REVIEW

2.1Gamification

Gamification stands for integration of game-related concepts and mechanics into non-gaming contexts, intended to impact behaviour. (Behl et al., 2020). It is also defined as a phrase that functions as a complete descriptor for improving enjoyment in several non-gaming contexts. (Deterding et al.,2011)

Gamification can be succinctly defined as a strategy that involves incorporating motivational elements into services and products to generate gameful experiences and subsequent behavioral outcomes. (Zichermann & Linder, 2010) Many different game mechanics like score, level, progress bar can be used in order to provide an effective engagement and business success.. (Deterding et al., 2011)

Essentially, gamification aims to elicit similar psychological experiences as traditional games. These experiences include a sense of autonomy and control, mastery and achievement, social interaction, competition, as well as immersion and flow.

In the world of gamified experiences, users are exposed to a wide range of components that all work together to enhance the experience. The empowerment of autonomy and control, which gives participants a sense of agency and influence over their actions and decisions, is fundamental to these experiences. This is accompanied with the quest for mastery and success, as people overcome difficulties and hurdles and feel a great feeling of accomplishment after doing so. (Botte et al., 2020)

On the other hand, a game is a thoughtfully designed imaginary world with specific rules, typically played within a defined time and place. (Huizinga, 1950) Through gaming, individuals can engage with others, discover more about themselves, and enhance various social skills. Games effectively capture attention by introducing novel settings that stimulate cognitive processes and behaviours. (Sutton-Smith, 1997)

It is helpful to define the term "gamification" because it is used interchangeably in both academics and industry. The Becker study table, which is displayed below, offers a comprehensive explanation of a number of terms related to games. (Becker, 2021)

Distinctions between Types of Teaching & Learning using Games

© K.Becker 2021	Game	Serious Game	Game for Learning (G4L)	Game-Based Learning (GBL)	Game-Based Pedagogy (GBP)	Gamification
Basic Definition	This term includes **BOTH** Serious Games AND Games for Learning	A game ***designed*** for purposes other than or in addition to pure entertainment.	A game ***designed*** specifically with some learning goals in mind.	The process and practice of ***learning*** using games. [From the ***learner's*** point of view]	The process and practice of ***teaching*** using games. [From the ***teacher's*** point of view]	The use of game elements in a non-game context.
Purpose	Can be for any purpose.	Change in behaviour, attitude, health, understanding, knowledge.	Normally connected with some educational goals.	**Not a game** - this is an approach to learning.	**Not a game** - this is an approach to teaching.	Often used to drive motivation, but can also be used to make something more playful and game like.
Primary Driver (why used)	Can be either play or rewards (or both).	To get the message of the game.	To learn something.	To improve learning. To increase learning effectiveness. **Note GBP & GPL are related, but not the same.*	To improve teaching practice & effectiveness. **Note GBP & GPL are related. They are like two sides of a single coin.*	Depending on how it's implemented, it can tap into extrinsic or intrinsic rewards (or both)
Key Question	Is it fun?	Is the message being received?	Is it effective?	Am I learning what I am supposed / need to be learning?	Is it effective?	Business: Does it improve profits? Education: Is it effective?
Focus	Player Experience *(how)*	Content / Message *(what)*	Content / Message *(what)*	Learning Objectives *(what & how)*	Learning Objectives *(what & how)*	User Experience *(how)*
Budgets	Next to nothing to 100's of millions.	Next to nothing to 100's of thousands.	Next to nothing to 100's of thousands.	Usually part of an institutional budget. Largely irrelevant to the user.	Usually part of an institutional budget. Largely irrelevant to the user.	Next to nothing to 10's of thousands.
Business Model	User Pays	Producer Pays	Varies	Institution Pays	Institution Pays	Producer Pays
Concept Catalyst	Core Amusement.	Message.	Performance or Knowledge Gap	Game is the lesson or is used as a part of the lesson.	Game is the lesson or is used as a part of the lesson.	When used in learning it usually impacts HOW things are taught and administered rather than WHAT is taught.
Fidelity	Self-consistent, otherwise irrelevant	Faithfulness to message essential	Faithfulness to message essential	Faithfulness to message essential	Faithfulness to message essential	Not Applicable. If a narrative exists, it need have nothing to do with what's being gamified.

Figure 1.Game- Gamification

Self-determination theory (SDT) is also really related to gamification and game. People can feel the same sense while playing games. (Ryan & Deci, 2017) Studies that have focused on video game experiences specifically have looked at how playing video games affects psychological processes and well-being (Przybylski et al., 2010)

Gamification is increasingly acknowledged as a potent strategy for boosting user activity and fostering social interaction. It plays a pivotal role in cultivating positive usage patterns and sustaining user engagement. The emergence of "gameful" experiences is a direct result of incorporating positive and inherently motivating game elements into products or services (Hamari et al., 2014)

Gamification has become a prominent design approach, widely adopted by designers in various projects. As a result, many users are likely familiar with gamified products, influencing their expectations for similar interactive experiences in new projects (McGonigal, 2011).

The implementation of gamification in business or learning environments significantly enhances the user experience, primarily through the elevation of motivation when users are presented with a personalized context (Eisingerich et al., 2019). Personalization plays a pivotal role in this scenario, as it tailors services and content to the unique preferences and needs of individual users. According to Xi and Hamari (2020), the provision of personalized services and content not only heightens user commitment but also fosters brand loyalty.

Additionally, gamification distinguishes itself as a useful tool for marketers by providing a way to collect vital information about purchase. (Milanesi et al., 2022). In addition to collecting data, gamification is essential for users that they feel like they belong to a community. In addition to increasing user engagement, this community-building element also helps to increase brand exposure and promotes advertising among customers and prospective buyers. (Glover ,2013)

Moreover, gamification serves as a valuable tool for marketers to gather essential data on consumer behaviour, preferences, and attitudes, shaping future marketing strategies. Additionally, it cultivates a sense of community among users, promoting a feeling of belonging and encouraging them to share their experiences with others. (Milanesi et al., 2022)
This, in turn, amplifies brand awareness and facilitates word-of-mouth marketing. In summary, the incorporation of gamification proves to be a potent instrument for marketing professionals aiming to enhance their brand's marketing strategies. (Glover, 2013)

It's crucial to remember that "gamification" isn't limited to digital technology, even though the majority of its applications nowadays include digital platforms. (Deterding et al.,2011) The merging of media and widespread computing are blurring the lines between digital and non-digital content. In addition, games and game design are categories that are applicable to a variety of media (Juul, 2005)

Numerous studies have shown that gamification in the e-commerce industry is a successful strategy for raising consumer satisfaction levels. (Raman 2021). According to Aparicio et al. (2019), incorporating gamification strategies into digital business models even helps to raise the rate of repeat purchases.

Recommendation systems can also display certain examples of gamification. According to Hajarian and Hemmati (2020), developing humorous and data-driven marketing techniques in the e-commerce industry is beneficial for generating revenue.

A gamified word-of-mouth recommendation system was suggested in another study, and the findings indicated that the system was successful in raising user engagement on the e-commerce website in addition to improving sales.

2.2 Game Design

Game design is a comprehensive methodology that involves the application of a set of rules to craft games for diverse purposes, as emphasized by LeBlanc (2004). Effectively managing the entire game design process, from inception to completion, is pivotal. Adhering to fundamental game design principles becomes crucial, significantly enhancing the likelihood of success when integrating game dynamics into non-game contexts. A systematic approach to game design ensures a structured and purposeful implementation of rules, contributing to the overall success and effectiveness of gamification strategies beyond the realm of traditional gaming environments. (Leblanc, 2004)

Typically, the development journey follows an iterative process, involving repetitive stages of testing and refinement. In the course of revision, there may arise the need for additional design elements or a complete redesign. (Hammerschall, 2019)

A gamification design, for instance, incorporates a motivating component into a website, application, service, or product. Similar to playing games, users appreciate the interaction, challenges, and competitive spirit here, which is why they are encouraged to return. (Goethe, 2019) Furthermore, players are greatly motivated by the game mechanics. These components have a connection to tasks and offer incentives to individuals who complete them. Users are

compelled to keep trying new things and use the interfaces more due to their excitement and curiosity. (Michael & Chen, 2005)

2.3 Gamification Frameworks

Marczewski proposed GAME (Marczewski, 2012) a more straightforward paradigm, in 2012. There are two phases of it. Initially, preparing and executing requires collecting important data , such as user kinds in the context of gamification.The optimal goal- and engagement-oriented solution is then created, tracking user actions and results. RAMP framework (Relatedness, Autonomy, Mastery, Purpose) is also in the centre of this gamification framework.

Werbach and Hunter's (2012) Six Steps to Gamification (Werbach & Hunter, 2012) presents the most well-known design framework, which is referred to as 6D. This methodology begins with defining the business objectives , conduct a study on users, creates a game flow, and, lastly, implements the gamification system using the necessary resources. (Mora et al., 2015)

In addition to various gamification frameworks, the MDA framework offers a distinctive perspective, primarily concentrating on game mechanics, dynamics, and aesthetics, as highlighted by Hunicke, LeBlanc, and Zubek (2004). According to this framework:

Mechanics: This represents a systems in a game. It involves the fundamental elements that define how the game operates, such as goals, challenges, and the ways players interact with the game.

Dynamics: Dynamics refer to the interactive aspects of the game. It encompasses the behaviors and patterns that emerge as players engage with the mechanics. This stage focuses on the system's runtime behavior and the experiences players have during gameplay.

Aesthetics: Aesthetics in the MDA framework go beyond visual appeal; it involves the emotional responses and experiences of the players. Aesthetics encompass how the game makes players feel and the overall enjoyment derived from the gaming experience. (Hunicke et al., 2004)

The Octalysis framework is designed to analyze and understand the various factors that motivate individuals in different contexts, including business, education, and personal development. The framework is represented as an octagon, with each side corresponding to a different core drive or motivational factor. (Octalysis, 2015.)

Octalysis framework has two motivational categories: intrinsic and extrinsic motivators. It is called octalysis because it takes its name octagon shape.The left side of the octagon represents extrinsic motivators, which are more external and tangible, while the right side represents intrinsic motivators, which are more internal and emotional. The upper half of the octagon focuses on positive motivators, while the lower half focuses on negative motivators.

2.4 Intrinsic and Extrinsic Motivation

If people wants to do tasks or responsibilities it means they find them fascinating and relevant, this is known as intrinsic motivation. It is the motivation that comes from within an individual rather than depending on other sources. However, external motivators are what propel intrinsic motivation. It states that the extrinsic benefits of an activity—rather than the activity itself—are what lead to enjoyment (Gagné & Deci, 2005)

According to Ryan games are naturally motivating because they are developed and design to meet the needs of the player. (Ryan et al., 2006) For example, intrinsic motivation is facilitated by the performance feedback from point mechanics, which raises the feeling of competence. It can be also increased by the narrative mechanic, which raises perceived autonomy and has a higher level of personal value or interest.

2.5 Game elements

Many game elements can be used while designing a gamification application. Some crafted solutions may use very well-known elements like Points, levels, and classification tables (Zichermann and Cunningham, 2011, Hamari et al., 2014, Seaborn and Fels, 2015, Chou, 2015). Others wishing to make innovations on creating a visually aesthetic game like solutions can use other types of elements of games like avatar, level, clash, challenge. PBL stands for point, badge and Leader board and these elements are commonly used among different business domains and educational applications (Cugelman, 2013).

The most commonly used gamification features in e-commerce platforms are leaderboards, badges, and rewards. Gamification components can enhance consumers' purchasing behaviour when combined with specific game aspects, thus managers and e-commerce designers should integrate them extensively into online shopping platforms. (Azmi et al., 2021)

2.6.E-commerce

A wide range of online commercial transactions involving products and services are included in what is known as electronic commerce, or e-commerce. It also covers any form of business transaction in which parties conduct business electronically as opposed to in-person exchanges of goods or services or direct physical contact. (Gupta, 2014)

There has been a gradually expanding of e-commerce retailing, with a growing number of individuals opting to conduct their purchases through this platform. (Alejandro García-Jurado et al., 2021) Additionally, e-commerce has play important role in economies. While it is widely adopted among younger consumers, a notable portion of potential consumers remains unfamiliar with e-commerce, as highlighted (Soh et al., 2020)

Scholars and practitioners have become more interested in gamification since its conceptual inception in 2010 (Hamari, Koivisto, & Sarsa, 2014). Along with gaining supporters, the strategy has gained momentum which state that the majority of businesses and organisations would use gamification in the near future. Businesses have embraced gamification in particular, using it to create customer loyalty programmes because they see it as a useful tool for engaging with their customers.

2.7 Loyalty programs

A customer loyalty programme, sometimes referred to as a reward programme, is a marketing tactic intended to increase the lifetime value of present customers by establishing an engaging relationship that provides recurring prizes to devoted patrons. In the late 20th century companies saw the rise in popularity of this strategy as businesses discovered that keeping current clients is more economical than finding new ones. (Kumar & Kumar, 2018)

These days, loyalty programmes are thought to be crucial for growing a firm's customer base and fostering greater brand connection. (Mohammadi, 2020)Because customer loyalty has a major impact on consumers' financial value, it is important to emphasise in marketing strategies.Loyal clients are more likely to be resistant to competitive offers from competing businesses since they tend to be less price-sensitive. This financial resiliency fueled by loyalty increases the customer base's total profitability. (Sundjaja et al., 2022)

2.8 Sustainability

Global attention has been drawn to sustainability issues, with renewable energy sources emerging as a critical area of study in sustainability studies. (Karthin & Hossein Eslami, 2023) Products intended to benefit stakeholders socially and economically while reducing environmental effects across every stage of their life cycle are referred to as "sustainable products" (Ahmad et al., 2018). A complex system encompassing multiple operations, including farming, animal activities, processing, shipment, setup, usage, and disposal of waste, is revealed when looking at the production and consumption of food (González-García et al., 2018).

Although many organisations and sustainable incentives try to raise the awareness on environmental issues, people are tent to ignore these problems or take no action. (Diekmann & Preisendörfer, 2003)

Livestock may be responsible for as much as 18% of the global warming effect (Smil, 2013) Rather than serving to feed people, most crops are used to feed animals (Weber & Matthews, 2008) According to estimates, beef has nearly three times the carbon intensity of pork or chicken and ten times the carbon intensity of fish (Carlsson-Kanayama et al., 2003)

In Europe, the food are the main causes of global warming due to the usage of natural resources during producing and consuming. The percentage is higher than the impact of housing and transport on climate change (European Commission, 2006) (Salonen et al., 2018) Reducing the amount of food derived from animals in human diets can have both ecological and health benefits (Springmann et al., 2016)

Recycling can improve the environment, there is no doubt about it. It comes without saying that recycling that reduces environmental pollution and harmful wastes improves human health right away.

CHAPTER3. ANALYSIS

3.1 Requirement Analysis

Requirements analysis, comprehension, defining, and verifying client and user requirements are all part of the engineering process. (Nora et al., 2006) Users and developers collaborate to plan the final look and feel of the programme at this stage. They discuss the functions, reports, and information to be stored as well as how to protect the application. It's crucial since a single alteration to what's required could require rewriting the entire application. That implies more labour and a longer completion time. (Hussain & Sumari, 2016)

In light of this information, it is imperative to systematically identify the project's requirements through a scientific approach. Among the various requirement elicitation techniques employed, scenario analysis, use case, and prototyping have been utilized to ensure the implementation of a desirable and usable product. Additionally, adherence to SDLC principles is deemed essential for the success of the project.

3.2 Requirement List for an e-commerce

The e-commerce website that is intended to be created must have a few essential features. A shopping cart, membership, an easy-to-use interface, and the purchase procedure are a few examples of these. It is also crucial for the planned interface to be responsive in today's mostly mobile user environment since this ensures accessibility and compatibility.

3.3 Gamification Requirements

There are some requirements for the designed eco-friendly GreenPlay gamification in the e-commerce website. The user needs to see the game panel, view assigned tasks, advance levels upon completing relevant tasks, view any recognized badges or vouchers on the game panel when completing a task, and be able to see and use them when necessary.

As a summary, a Requirement List covering both the needs of e-commerce and gamification can be seen as follows:

Functional Requirements	Non-Functional Requirements	Game Requirements
• Register • Login • Browse • Add to basket • View basket • Calculate total • Redeem voucher • Choose delivery method • Payment • Sign out	• Normalisation • User-Centred Design • Responsive design • Valid e-mail format • Usability • Compatibility	• Browse game • Assign task • Level up • Give Voucher • Give badge

3.4 Game Elements to Use

The concept of gamification encompasses a wide range of elements and techniques. (Zichermann & Cunningham, 2011) You can use any one alone or in combination with the others. (Chernbumroong et al., 2019) Carefully consider which aspects to employ in a given setting; otherwise, the gamification features may cause more harm than good. (Matenga et al., 2018)

Achievements and badges

The visual representation of accomplishments that badges and achievements provide fosters a competitive spirit and a drive for progress. (Cugelman, 2013) Additionally, the visual representation of a player's completed levels through achievements and badges might incite competitiveness among other players in the community. (Hamari & Koivisto, 2013) (Julius & Salo, 2013)

Levels

In order to encourage sustained involvement, levels present stages of the game that get increasingly more intense (Paharia, 2013). Each level has an objective and ends with a success of some kind.

Competition and challenge

Challenges and competitions encourage success by fostering healthy competitiveness intended to resolve a particular issue of a complicated state (Cugelman & Eysenbach, 2013)

Progress Bar

A progress bar is a tool that helps learners keep track of their progress or find their place in a learning exercise. Codish and Ravid (Codish & Ravid, 2014) showed that playfulness and progress bars had a positive association for different kinds of individuals.

Timer

Users' task completion times may change if a countdown element is included, and this raises concerns about the connections between task completion time, motivation, engagement, and focus. (Matenga et al., 2018)

Avatar

Using avatars is a popular gamification strategy. (Johnson et al., 2016) Once more, the vast majority of research revealed that avatars had favourable effects. (Kuramoto et al., 2013) Because it gives the sense of belonging to the system when users meet a personalised content.

Rewards

According to Dominguez (Domínguez et al., 2013) using a rewards system to symbolise achievement within an online learning environment is creative, enjoyable, and motivating.

Storyline

To enhance the learning experience, the educational material incorporates the use of storylines, as advocated by Frost et al. (2015). By contextualizing the content within a narrative framework, learners are provided with a more meaningful and engaging educational

experience. Storylines serve as a powerful tool to connect theoretical concepts with real-world scenarios, making the learning process not only informative but also immersive and relatable

3.5 Gamification Framework for GreenPlay

Clearly, there is a necessity to define the scope for the implementation of gamification. The GreenPlay gamification is based on Kevin Werbach and Dan Hunter's "Six Steps to Gamification" framework. This framework consists of six fundamental stages and is also known as the 6D model, as each stage begins with the letter D. (Werbach et al., 2012)

In accordance with this strategic framework for gamification implementation, the foremost imperative is ensuring that gamification objectives align with the long-term goals of the company. This necessitates a meticulous process of behaviour elicitation, wherein a profound understanding of user behaviours is sought. Integral to this approach is the undertaking of detailed persona studies, delving into the intricacies of real users and their specific needs within the context of the gamified system. Subsequently, the design phase unfolds, encompassing the crafting of the game flow to ensure a cohesive and engaging user experience. Adding elements of entertainment is strategically interwoven into the design, injecting a captivating and enjoyable dimension. The final stage involves the judicious selection of tools and the formation of skilled teams, bringing the envisioned gamification strategy to life.

Below GreenPlay gamification framework has been designed in the light of the information given.

Objectives	GREEN-MARKET is a company with a product range primarily consisting of sustainable and environmentally friendly products, and it sells its products online. Increasing the loyalty of both existing and potential customers, boosting its market share in environmental products, and achieving profitability are among the company's immediate goals.

Behaviours	• Increase the number of registered users on the website • Enhance member loyalty • Increase the sales volume of sustainable products • Reduce shipment costs • Decrease the bounce rate • Reduce CO2 emissions • Follow sustainable policies • Raise awareness about recycling • Protect the environment
Players	Green-Market customers, both current and prospective users, are natural participants in this game.
Flow	**Activity Cycle:** Users review assigned tasks. When they successfully complete the tasks, the system provides feedback. This feedback can take the form of vouchers or badges. **Progression Stairs:** As users complete given tasks, they advance to a higher level.
Fun	Narrative style, reinforcement at the end of each task, badge issuance, countdown, level progression, rewarding, visual game elements.
Tools and Techniques	**Front-end Development: Bootstrap, HTML, CSS** ***Bootstrap*** facilitates the development of responsive and mobile-first web pages.

	HTML (HyperText Markup Language): Front-end appearance ***CSS (Cascading Style Sheets):*** Styling **Back-end Development: ASP.NET MVC, SQL** ***ASP.NET MVC***: Framework used for back-end and server operations ***SQL (Structured Query Language***): Database and Queries ***Usability Heuristics:*** Usability heuristics are broad principles that help guide the design and evaluation of user interfaces.

3.6 Gamification Flow

A gamification design named GreenPlay has been developed for the GREEN-MARKET e-commerce website to achieve the objectives mentioned above. In the light of these objectives, a four-stage game example has been designed.

LEVEL1 *REGISTRATION*	*LEVEL2* *RECYCLE*	*LEVEL3* *CO_2 PRINT*	*LEVEL4* *VEGAN*

Here, there are three primary sustainable behaviours that users are encouraged to adopt. The first is to reduce their carbon dioxide footprint, the second is to engage in recycling practices, and the last one is to use vegan products.

Level1. Registration

The game actually begins with the user visiting the site. Various prompts are used to engage the user in the game. During the first visit (detected by cookies when the page is first visited), a campaign pop-up message provides the user with the first clues about the game. A countdown emphasizes that this campaign is valid for a limited time, encouraging the user to decide quickly. (Matenga et al., 2018) Beneath this pop-up message, a registration button is placed, allowing the user to easily access the registration screen.

When the user registers, they are prompted to choose one of the avatars associated with the game. The aim here is to make the user feel they are natural player in the game through personalization.

After the registration process is completed, feedback is provided for the user's actions. This feedback informs the user that they have advanced to a higher level, earned a 50% discount on sustainable products, and can access these opportunities by exploring the game.

When users click on the game panel, they can view the badges and vouchers they have earned, along with their current level and progression.

Level2. Recycling

Choosing and using recycled products can contribute to sustainability efforts by conserving resources, reducing landfill waste, and minimizing the environmental impact associated with the production of new goods.

This level begins with clicking on Task2 in the game panel. Task2 involves purchasing recycled material products from among the product categories. Once the user buys one of these products, the level advances, and the next task appears.

Level3. CO_2 footprint

Making environmentally conscious choices in daily activities can reduce the CO2 footprint. In this level of the game, the aim is to convey the sense that reducing the CO2 footprint as an individual is simple and possible.

Task3 leads users to proceed with their purchase by choosing low CO2 print delivery methods. If users select either in-store pick-up or collection point options as the delivery method, the game awards the user with progress on the progress bar.

Level4. Vegan

Vegan products have many benefits in terms of sustainability including preserving water, efficient resource use, animal welfare and reduced CO2 footprint.

In a manner similar to previous steps, users can view the assigned task for this level on the game panel. Upon purchasing a vegan product, the user can earn a sustain-hero badge.

CHAPTER4. DESIGN

4.1 Prototype

The prototype studies have been conducted for a gamified e-commerce website, developing prototypes for both desktop and mobile platforms. These prototypes showcase the user interface and interaction design, illustrating the planned gamification elements integrated into the website.

The needs of an average e-commerce website user were determined based on fundamental UXD (User Experience Design) and usability principles. In line with this, sign-in/up and basket options were positioned on the right side. Placing the game panel on the right side, next to the basket icon, serves two usability purposes. Firstly, it attracts the user's attention, promoting engagement. Secondly, its proximity to the basket ensures easy accessibility, allowing users to interact with both elements conveniently. The card method was preferred for content alignment. Users can more easily skim and comprehend content when information is presented and organised using cards in a visually clear and structured manner.

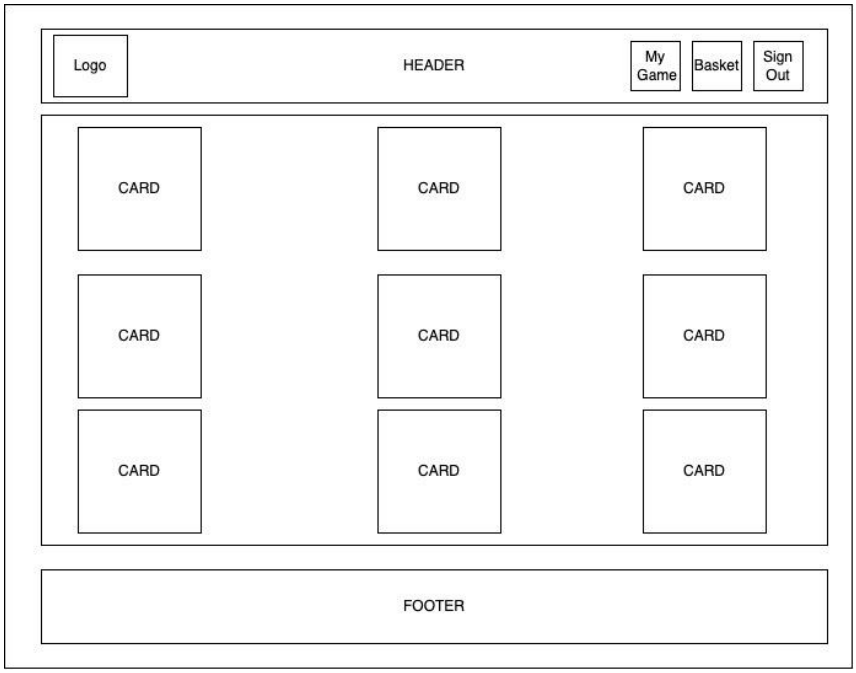


Figure 2.Web UI

Mobile UI

The website's mobile version likewise uses the same design theme. The website has been created to be accessible on a variety of devices, demonstrating the potential of Bootstrap. The game panel and other navigation options are available beneath a collapsible hamburger menu (seen by three lines) in the mobile design. This design decision makes the most use of screen real estate and offers a neat, easily expanding menu so that users may access a variety of features.

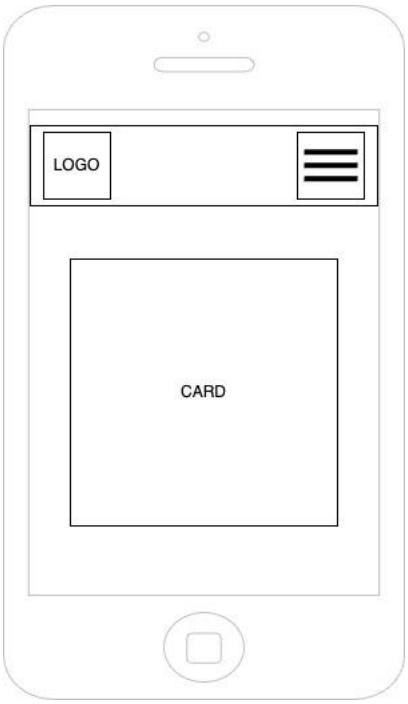


Figure 3.Mobile UI

Game UI

In accordance with analysis conducted and the identified elements, a dedicated game panel has been developed to ensure consistent visibility within the interface. This panel serves to present crucial information, including the current gaming level, the status of the progress bar, recently assigned tasks, earned badges and coupons, as well as the chosen avatar during the registration process. By consolidating these elements into a centralized game panel, users can readily access pertinent details related to their gaming journey within the gamified platform.

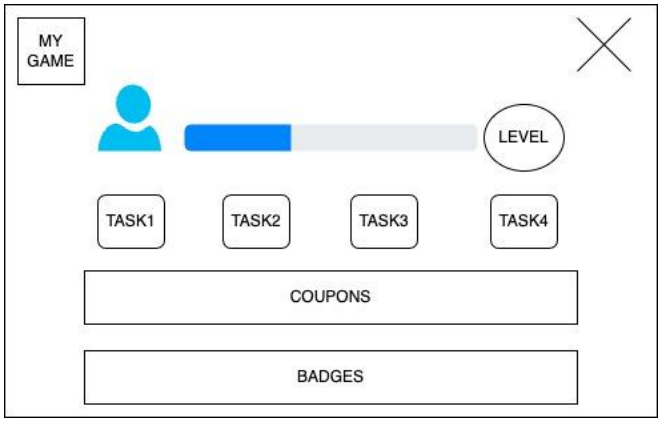


Figure 4.Game Panel

Figure 5.Registration Form

Recognizing the vital role of personalization for user engagement, particularly in the context of gamification, a deliberate effort has been made to incorporate personalized elements from the outset. In the initial stages of the gamification process, users are empowered with the choice to select their unique avatars by actively participating in the Green Play experience. This fosters a feeling of ownership and identity but also establishes a personalized connection between users and the gamified platform, contributing to a more immersive and enjoyable interaction.

4.2 Use Case

It is a type of diagram that falls under the umbrella of Unified Modelling Language (UML), which is frequently used in software engineering. (Mule et al., 2015)A useful tool for conducting high-level requirement analysis inside a system is a use case diagram. (Kušek et al., 2001)

During the process of examining the system requirements, the features are captured into use cases, which operate as methodically arranged representations of how the system functions. On the other hand, actors are entities that interact with the system; these entities might be either internal or external applications or human users.

A rectangle serves as the representation of the system. Primary actors in the system are those on the left, while secondary actors are those on the right. The user and member are the two main actors in this use case diagram, while the system admin is the only secondary actor.

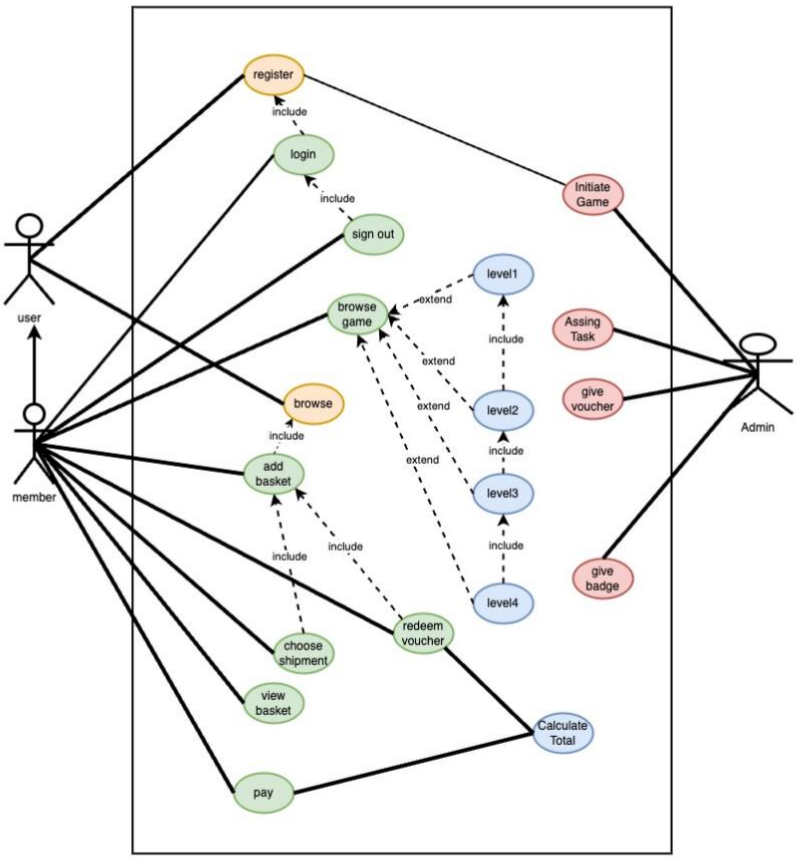


Figure 6. Use Case Diagram

Site visitors can only access navigation, product details, and the registration section. Registration is compulsory for those wishing to purchase products from the website. Once registered, users gain access to the game and its associated privileges. The system admin is responsible for game updates, task assignments, and determining rewards. Prerequisites exist between game levels, meaning users who haven't completed the tasks of the previous level do not have authorization to access the privileges and tasks of the next level.

4.3 Entity Relationship Diagram (ERD)

In the normalization process of databases, entity-relationship diagrams play a crucial role in illustrating the relationships between various entities (Song et al.,1995). These diagrams are highly effective tools, known for their simplicity, making them easy to comprehend. (Batini et al., 1992). Additionally, they show different entities relate to each other in a database structure. The entity-relationship diagram extracted from SQL Server Management Studio is presented below to clarify the relationships among various entities within the gamified e-commerce website system.

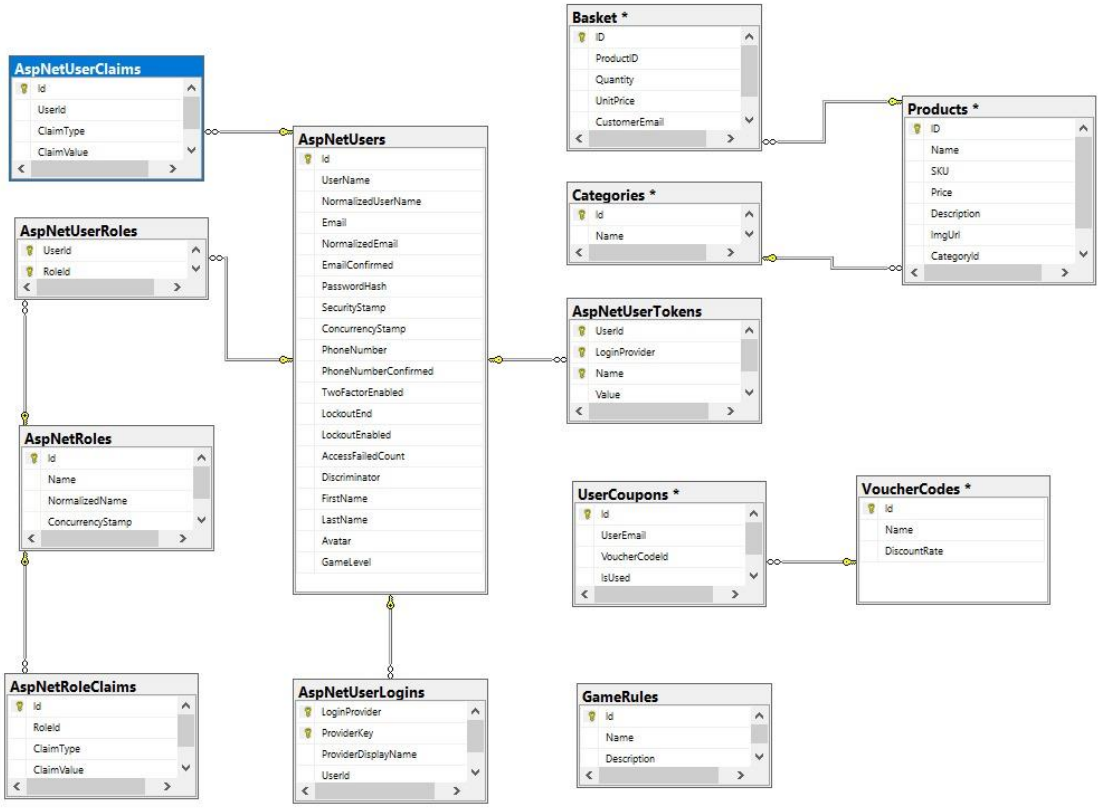


Figure 7.ERD Diagram

CHAPTER 5. SYSTEM IMPLEMENTATION

5.1 Overview

This chapter provides an in-depth exploration of implementation. It covers the development environment, coding and programming specifics, database implementation, system testing and a summary of challenges and solutions.

The implementation phase is instrumental in bringing the proposed e-commerce website with gamification to use. It transforms theoretical design concepts into a functional and interactive system, setting the stage for testing and refinement.

5.2 Development Environment

The e-commerce website with gamification was implemented in a dynamic software and hardware environment. Software components included ASP.NET for server-side scripting, Bootstrap for responsive front-end design, MVC architecture for modular development, and Microsoft SQL Server Management Studio for database management.

Key development tools encompassed Visual Studio as the primary Integrated Development Environment (IDE), Bootstrap libraries for front-end design, and Entity Framework for streamlined database interactions.

5.3 Coding and Programming

The coding process adhered to industry-standard conventions, ensuring maintainability and scalability. Below is an excerpt showcasing the MVC structure in the HomeController:

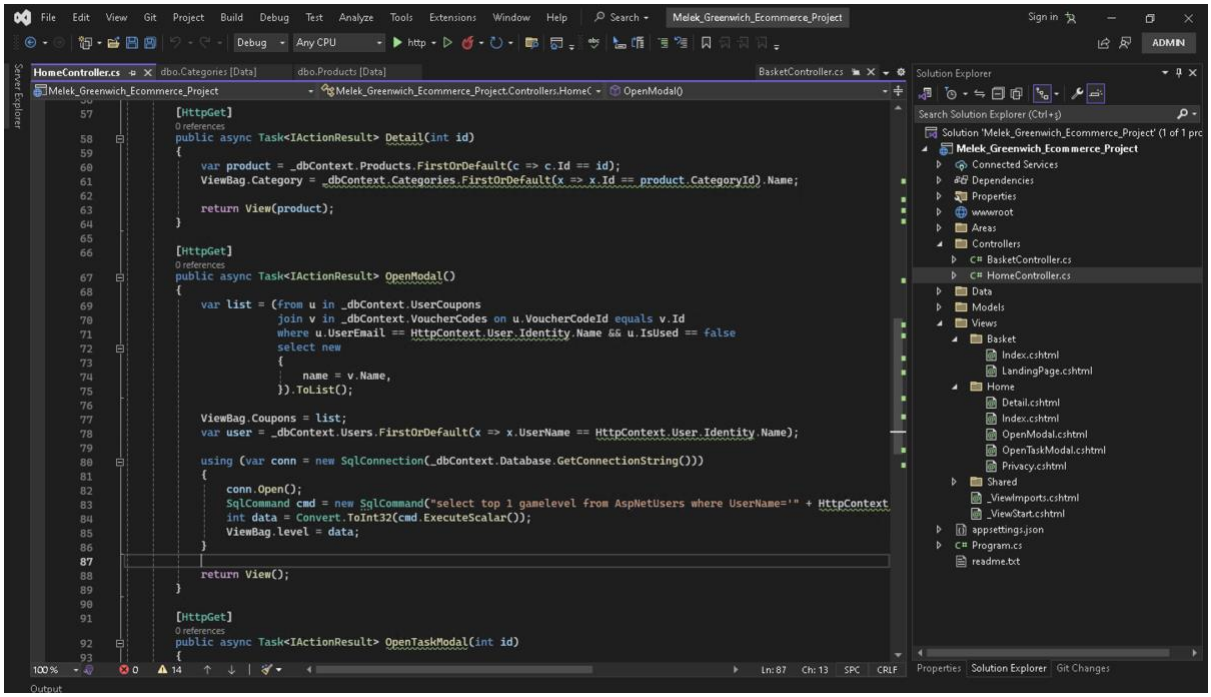


Figure 8.HomeController Code example

5.4 Database Implementation

The database schema, designed in the System Design chapter, was realized using Microsoft SQL Server. An illustration of the Product table:

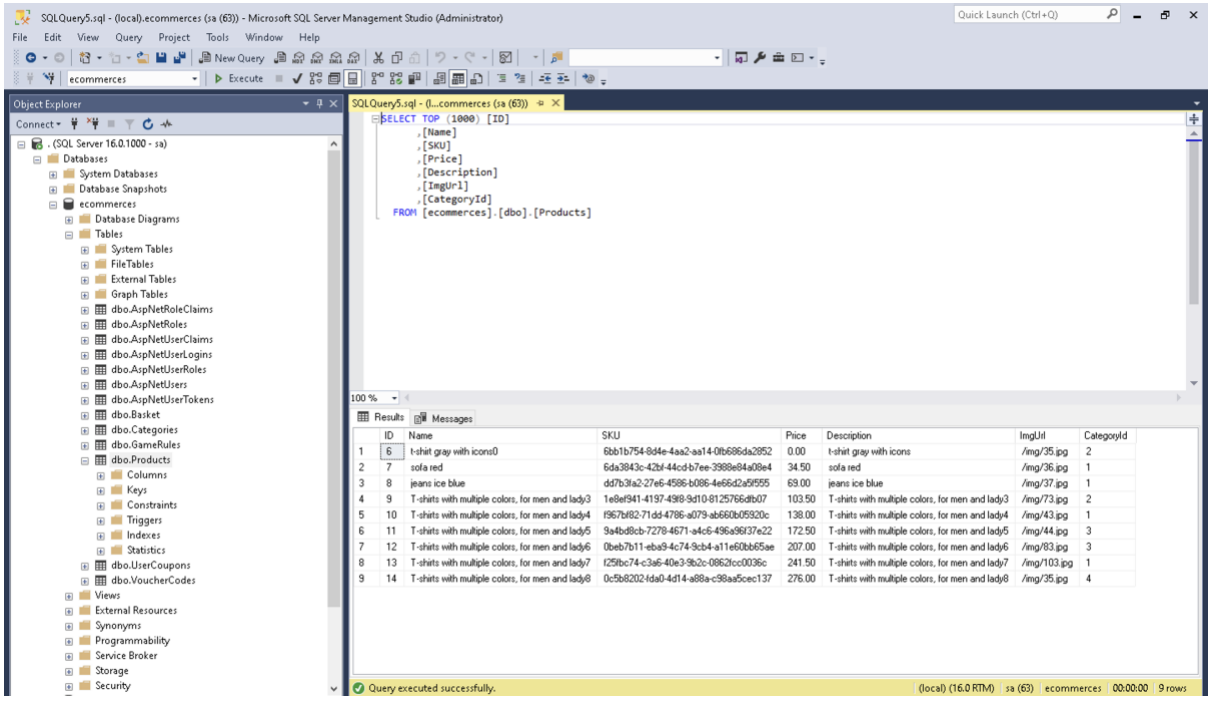


Figure 9.Product Table

6.TESTING

The GreenPlay game has been tested on a basic e-commerce website example in this section. The user interface has been crafted using Bootstrap, incorporating an aesthetically pleasing card view for enhanced visual appeal.

Within this interface, users can access detailed product information through both the card view and dedicated detail pages. The navigation panel displays the logo, menus, login, and registration and each item on the navigation work properly.

Design is simple, understandable, and characterized by ideal contrast.

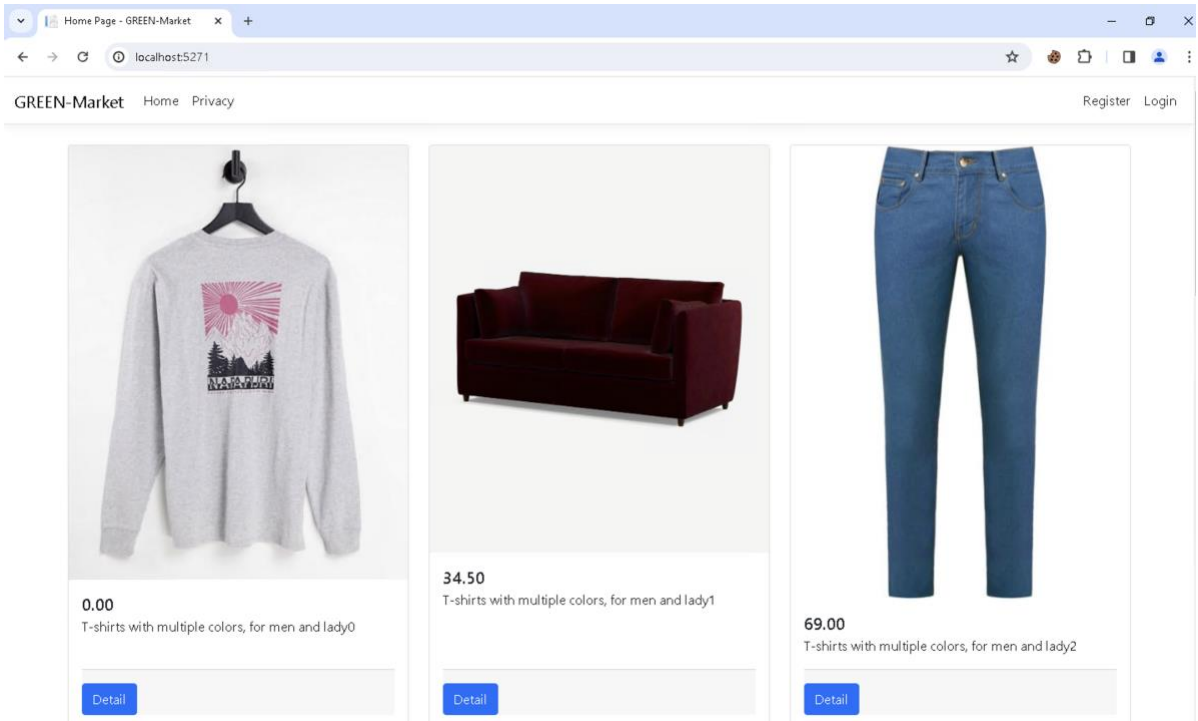


Figure 10.Index Page

Front-end design is also responsive. In the navigation, the logo, hamburger menu, and card view welcome the user. Access to login and registration is available through the dropdown menu.

As a mobile simulator, Chrome Inspector mode has been used to make sure a mobile appearance is provided, and it works correctly.

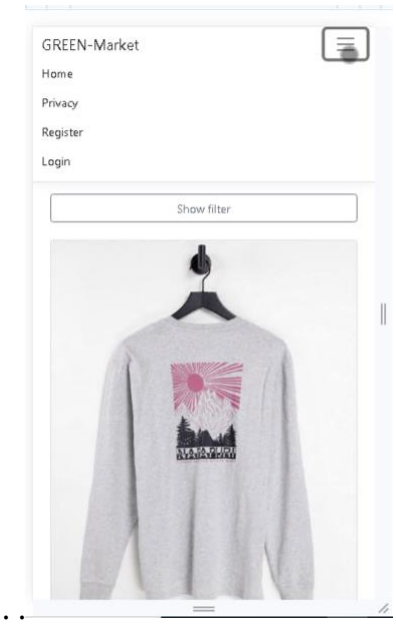


Figure 11.Mobile Menu

Figure 12.Mobile Homepage

The first-time visitors to the site are greeted with a pop-up window that provides initial clues about the game and includes a countdown element. The visibility of the pop-up is controlled through the 'mylandingmodel' on the cookie.

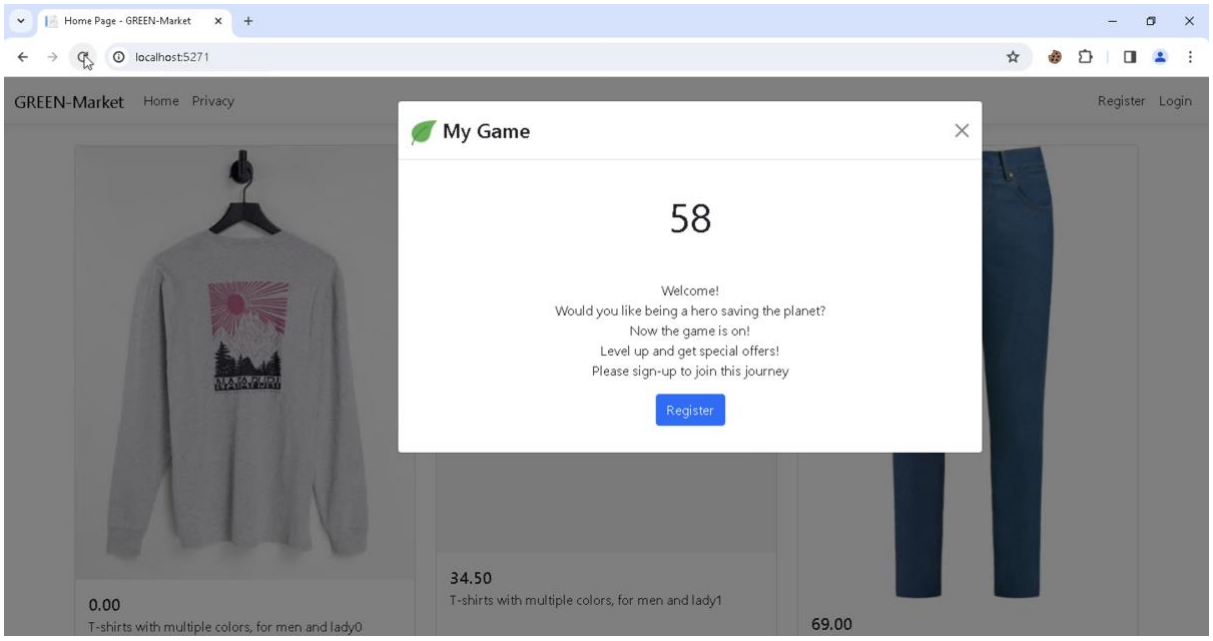


Figure 13.Welcome Pop-up for first visitors

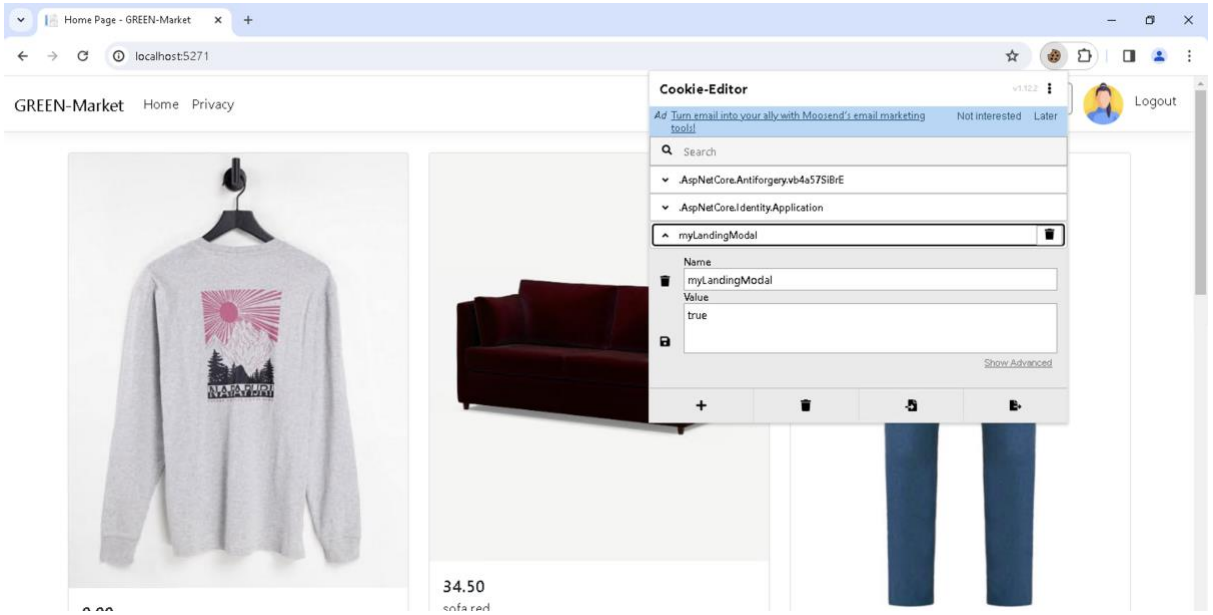


Figure 14.Cookie Control

The Register button directs the user to the registration screen. Here, the user must enter values that adhere to the email and password formats. The user also selects their avatar, which will be used in the game.

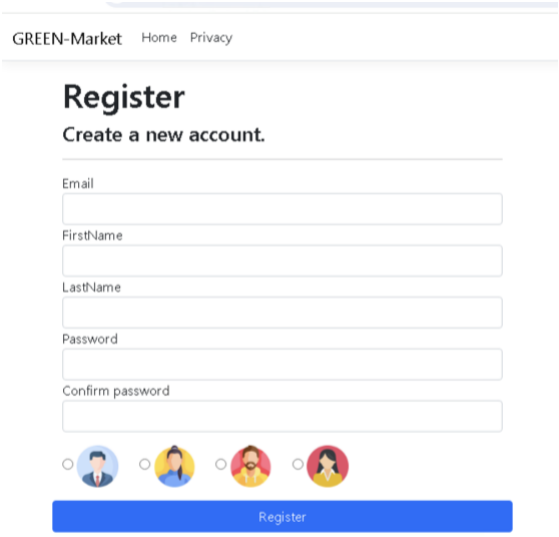


Figure 15.Registration Form

After the users successfully register, a feedback message is displayed on the screen, notifying them that they have progressed to the next level and earned a voucher offering a 50% discount on sustainable products. This feedback is communicated to the user through the homepage.

To facilitate user's access to the game and increase the likelihood of navigation on the site, a login button is visibly positioned below the message.

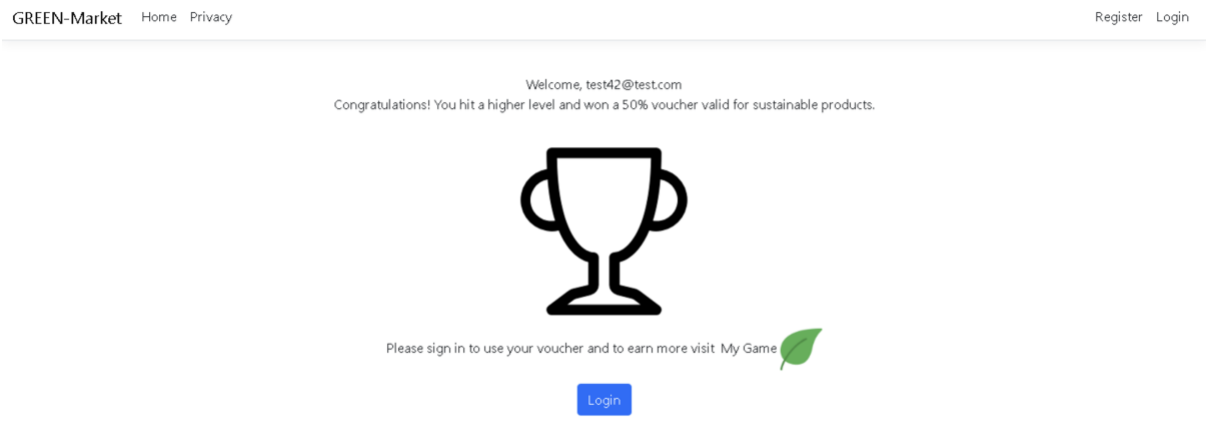


Figure 16.Feedback for the first level

When the user enters the correct username and password for login, the system initiates a session for the user. The 'My Game' menu appears on the right, next to the shopping cart. Clicking on the 'My Game' button brings up the game console on the screen.

In this console, the user's current level is visible in the circle on the right, avatar is chosen during the registration located on the right and the progress needed to complete for the relevant section can be understood from the progress bar. The discount voucher coupons earned from the previous level are added to the corresponding tab. As the user advances to the second level, the second tree symbol becomes unlocked. The tasks for the active levels can be viewed, and access to task details, rewards, and information is available. Sections regarding to the next level keep unlocked.

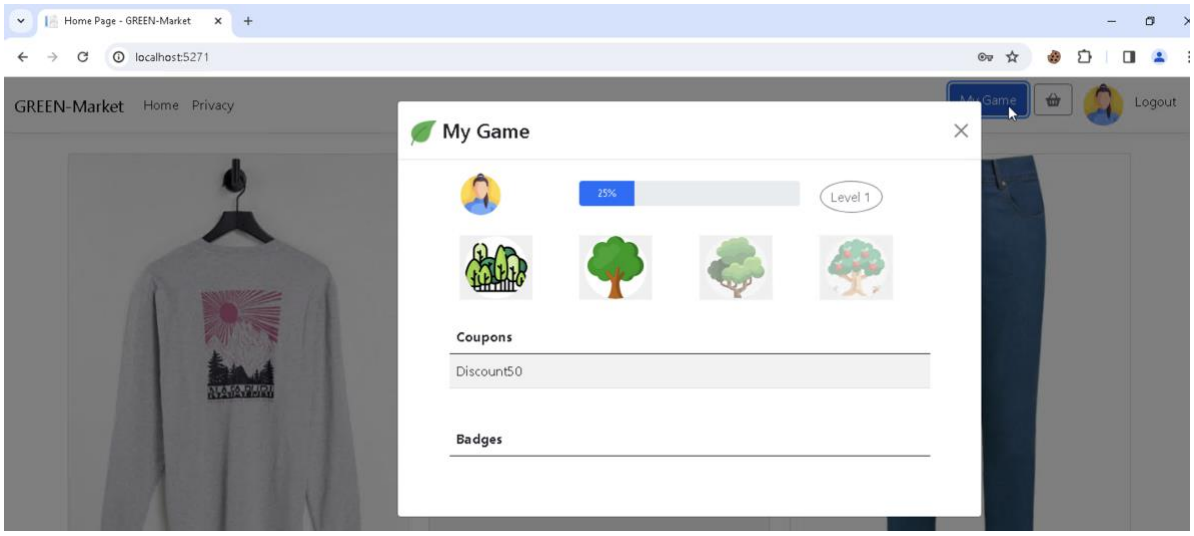


Figure 17.Game Panel view after levelling up

Upon reaching the second level after registration, if user attempts to access Level 2 tasks, the following screen appears. Here, there is a task related to purchasing recycled products. Upon completing this task, the users receive a message stating that they will contribute to energy savings and prevent pollution and waste.

Figure 18.Level2 Task Window

Product details can be accessed through the detail form. While creating product entries, sustainable products are stored to database table under different categories such as recycled, vegan, used, ecological.

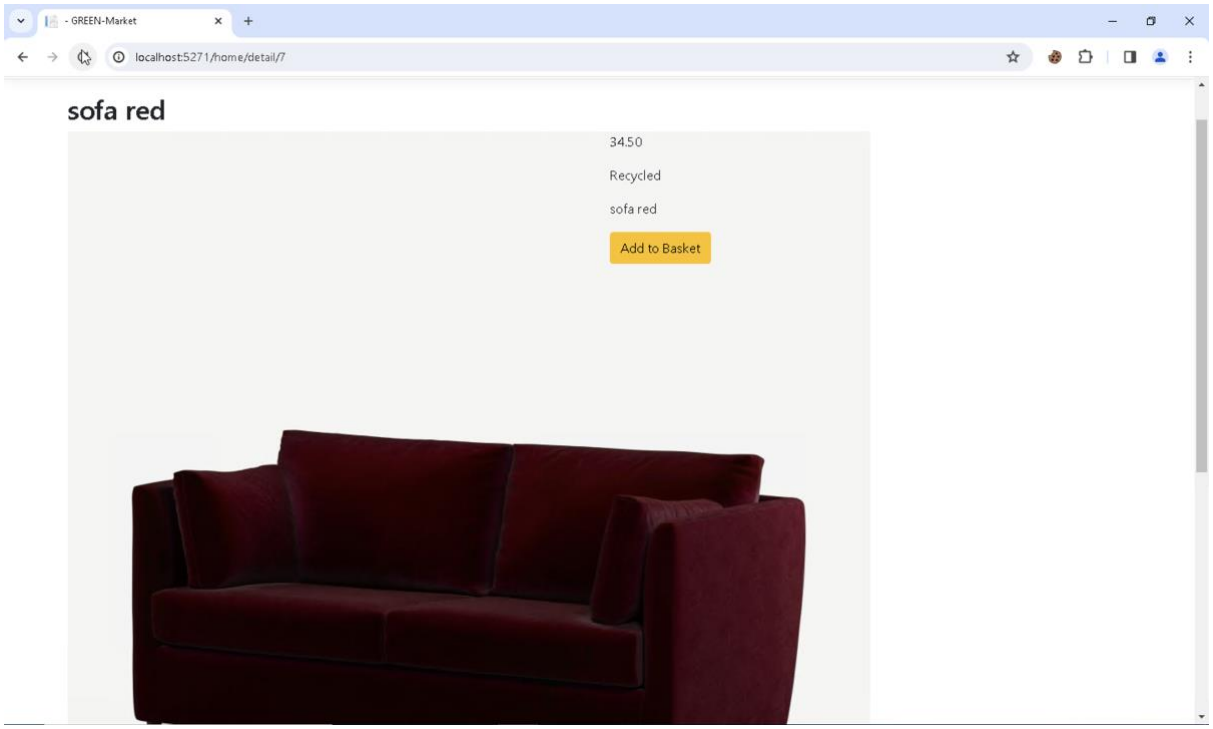


Figure 19.Product Details

The verification of each level's task, whether the user has purchased the desired product, is done by checking the category during the purchase process

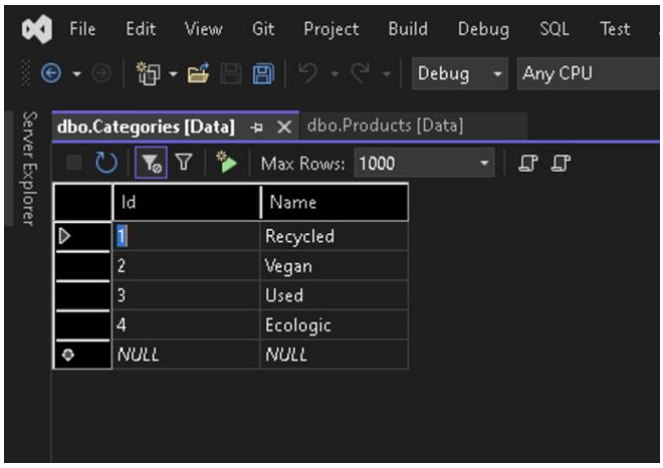
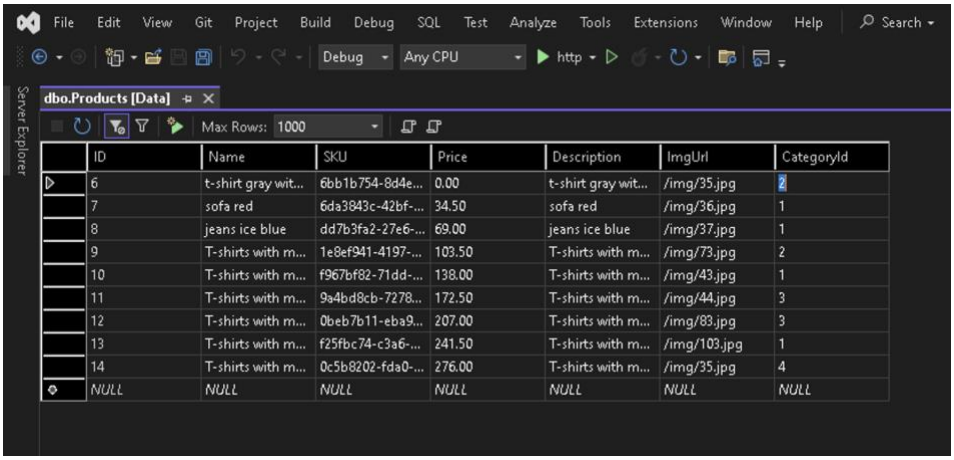


Figure 20.Database Category Table



	ID	Name	SKU	Price	Description	ImgUrl	CategoryId
▷	6	t-shirt gray wit...	6bb1b754-8d4e...	0.00	t-shirt gray wit...	/img/35.jpg	2
	7	sofa red	6da3843c-42bf-...	34.50	sofa red	/img/36.jpg	1
	8	jeans ice blue	dd7b3fa2-27e6-...	69.00	jeans ice blue	/img/37.jpg	1
	9	T-shirts with m...	1e8ef941-4197-...	103.50	T-shirts with m...	/img/73.jpg	2
	10	T-shirts with m...	f967bf82-71dd-...	138.00	T-shirts with m...	/img/43.jpg	1
	11	T-shirts with m...	9a4bd8cb-7278...	172.50	T-shirts with m...	/img/44.jpg	3
	12	T-shirts with m...	0beb7b11-eba9...	207.00	T-shirts with m...	/img/83.jpg	3
	13	T-shirts with m...	f25fbc74-c3a6-...	241.50	T-shirts with m...	/img/103.jpg	1
	14	T-shirts with m...	0c5b8202-fda0-...	276.00	T-shirts with m...	/img/35.jpg	4
◆	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 21.Database Product Table

If a product from the desired category, such as recycled, is added to the cart and purchased, then the user advances to the next level.

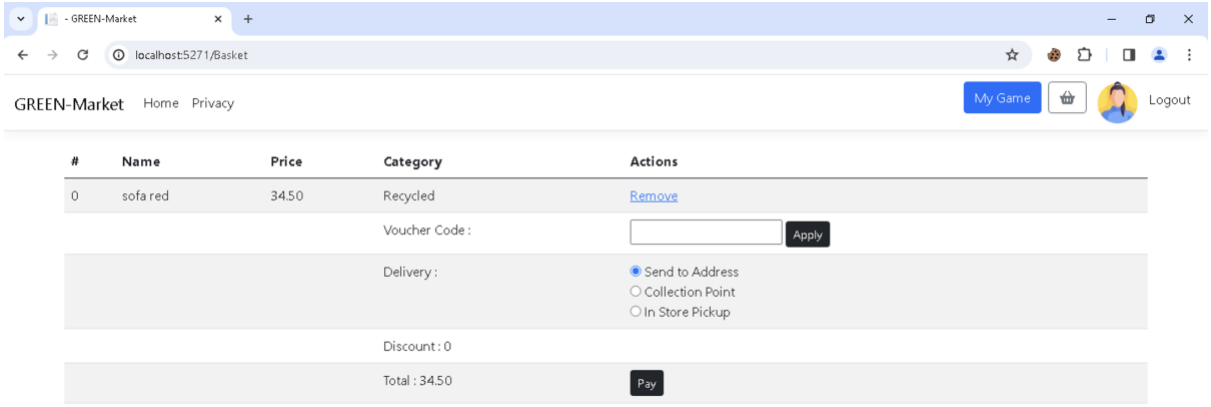


Figure 22.Basket view

When checking the game console, the progress bar has advanced, and the next level, which is Level 3, has become active.

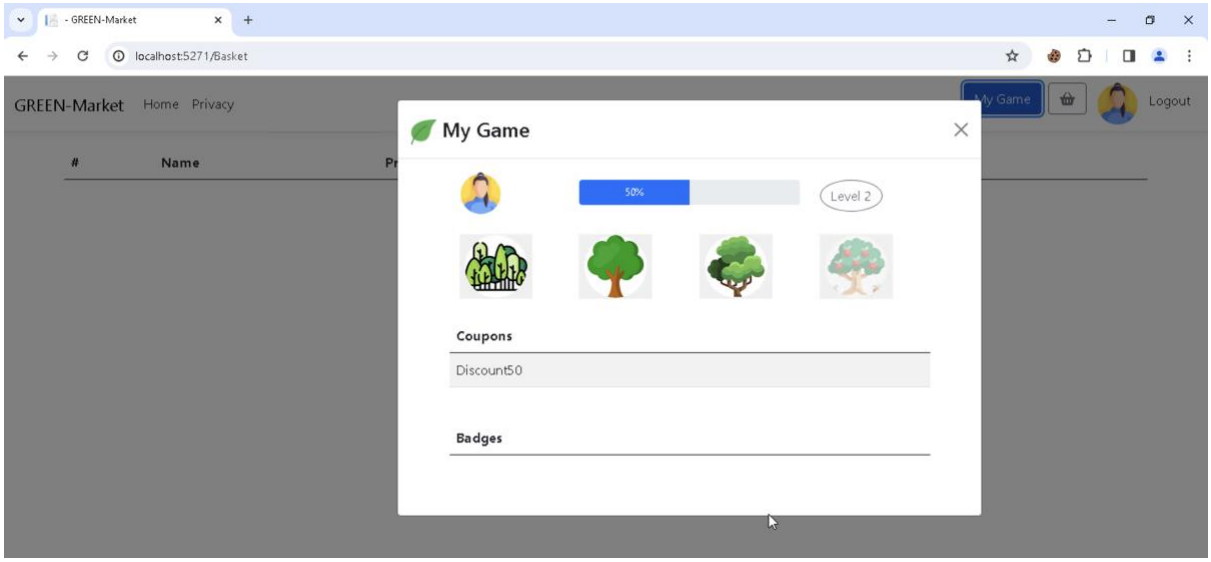


Figure 23.Level3 appearance after Levelling Up 3

The user clicks on the third icon for the next task, and a message appears stating that they can individually reduce CO2 emissions and thus protect the environment. The task here involves the user purchasing a product from the website and, during the purchase, choosing more sustainable shipping options, such as pick-up store or collection point.

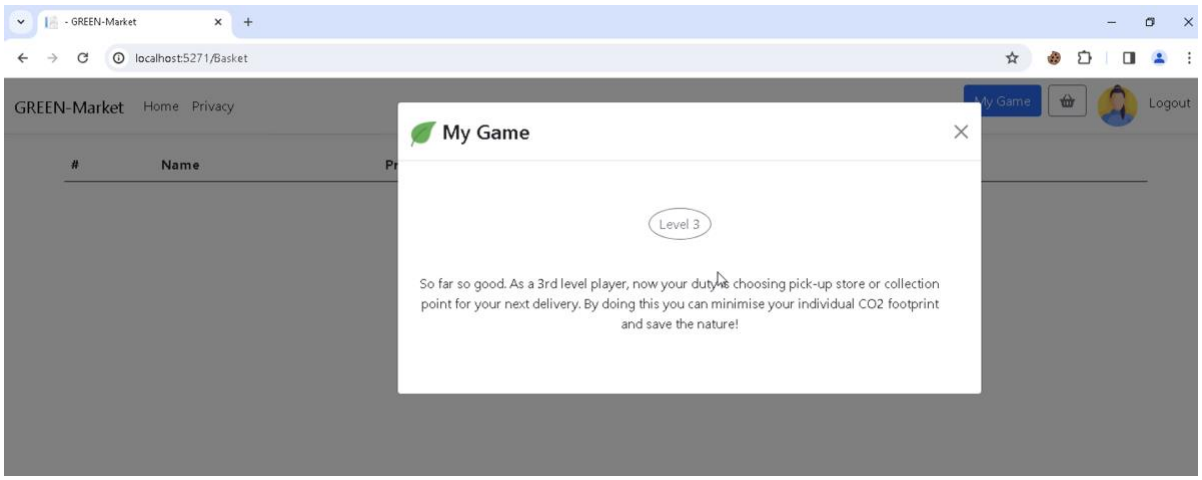


Figure 24.Task for Level3

If the user chooses one of these two options during the purchase, they advance to the next level, which is Level 4, and the progress bar moves one step forward.

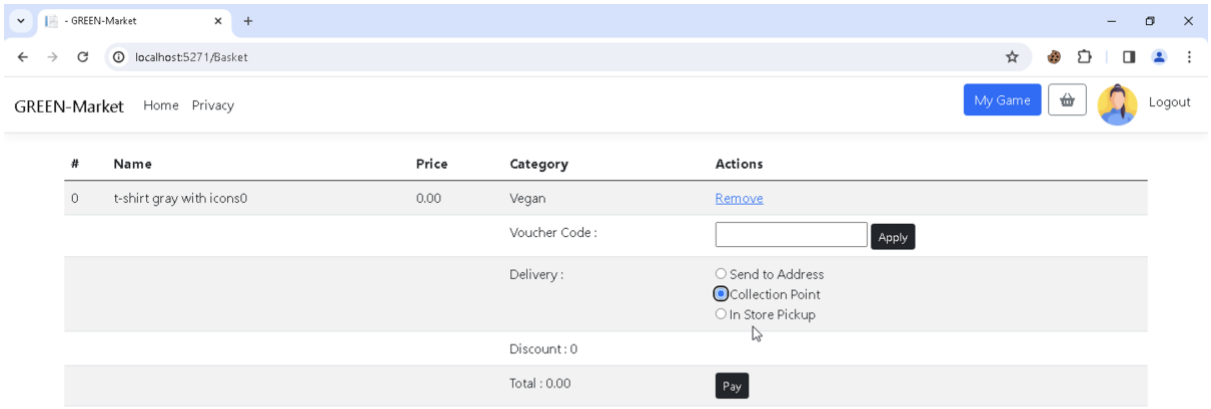


Figure 25.Basket view for delivery options

In the fourth level, the task is to purchase vegan products. The user is given a message that such shopping will conserve water resources. Upon adding and purchasing a product from the Vegan category, the user is rewarded with a sustain-hero badge.

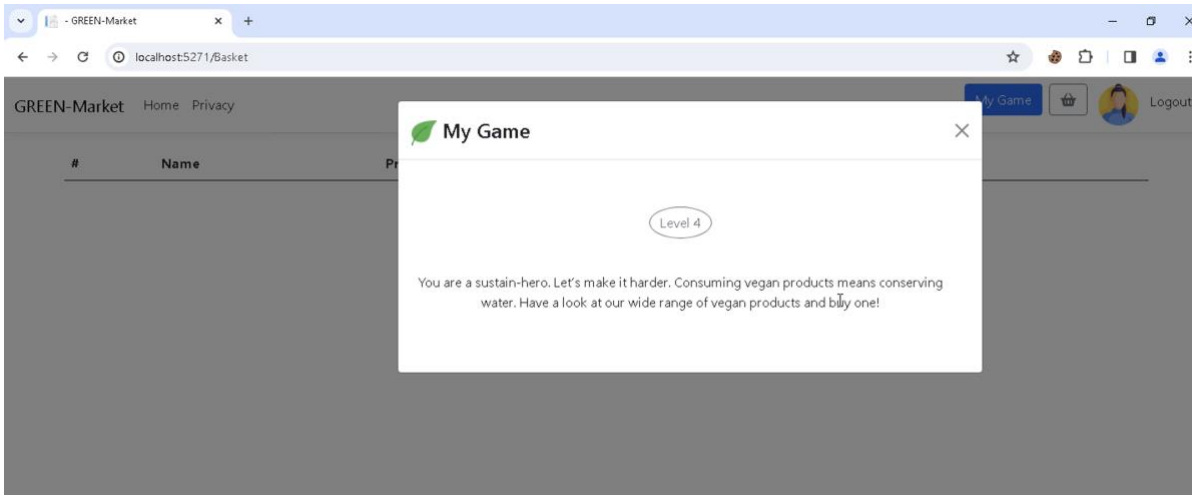


Figure 26.Level 4 Task

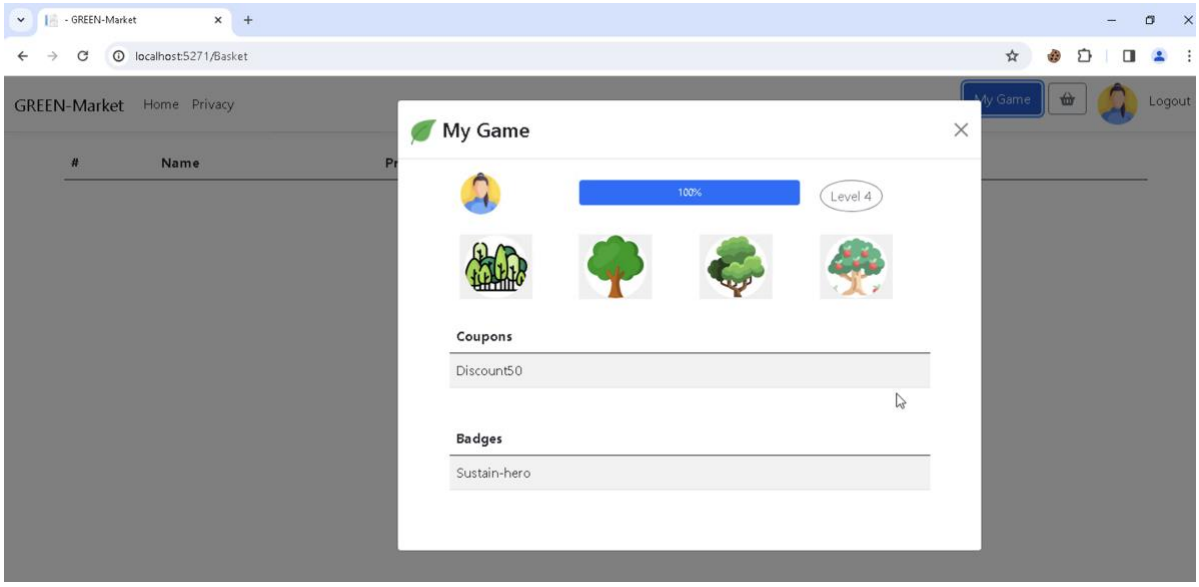


Figure 27.End of the game, Game Panel View

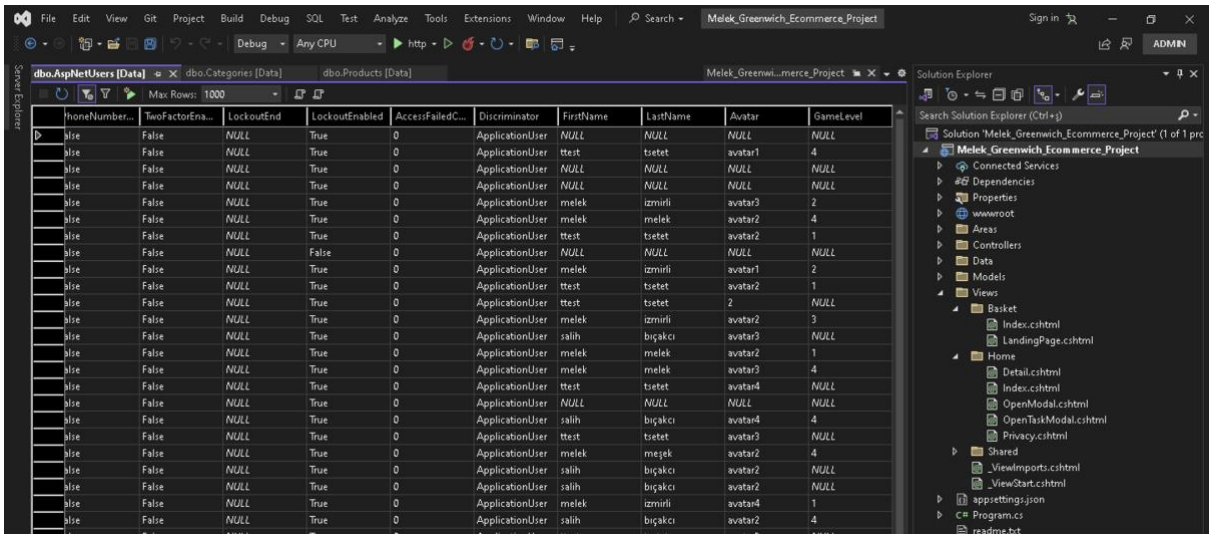


Figure 28.User Table with details/ level

6.1Usability Test

This user-centered methodology, often known as usability testing, offers insightful information on how users engage and navigate the product or service. (Nielsen, 1993) Through careful observation of users' behaviours, preferences, and obstacles, designers and developers can get a more profound comprehension of user experiences. (Rubin & Chisnell, 2008).

Nielsen heuristics, one of the interface design testing techniques, is a useful tool for quantifying design errors that affect user experience (YáñezGómez Rosa et al., 2017). To improve flexibility and recall features, the interface's design and visual elements are evaluated in accordance with Nielsen's heuristics (Szabo, 2017).

UI and UX text ensure that any website's interface may give a positive user experience and be successful (Pant, 2015).

Jacob Nielsen developed a set of design guidelines known as Nielsen's 10 heuristics (Nielsen, 1995) to evaluate the usability of interactive systems. According to Nielsen and NNGROUP, the ten heuristics investigate various aspects of a system's design and functionality, focusing on key principles that contribute to a positive user experience. The heuristics include considerations such as system availability and consistent feedback, alignment with familiar design patterns, user-friendly navigation, visibility of design and standards throughout the system, and flexibility combined with minimalism.

Following this heuristic approach, the e-commerce website—integrated with GreenPlay gamification—has been built with the goal of improving simplicity of use and facilitating recall—based on users' experience with e-commerce and related systems. The site's chosen style is straightforward and minimalistic, taking cues from well-known e-commerce designs and systems. Throughout, the design components and colours remain the same. Users receive the required feedback at every stage of gamification, increasing system visibility. The design works with a variety of gadgets.

7.CONCLUSION

This study aimed to build sustainable shopping behaviours among users by designing an e-commerce website blended with the Green-play gamification. The project commenced with an exhaustive literature review, exploring gamification concepts, frameworks, and noteworthy studies in the field. The subsequent phase involved providing detailed insights into optimal game elements that align with an effective game design, extending from the chosen framework to foster the desired sustainable behaviours. A meticulous requirement elicitation study was conducted to cater to both the foundational aspects of an e-commerce website and the specific requirements of gamification. The implementation phase was the selection of the most suitable coding and database tools and resulted gamified e-commerce website. The product's compatibility with the designed gamification was assessed through functional testing, ensuring seamless integration. Additionally, a usability test was conducted to refine and enhance the overall user experience. This comprehensive approach underscores the dedication to creating an impactful and sustainable e-commerce platform, harmonizing user engagement with gamification and environmental consciousness.

The most successful part of this project is the selection of the most appropriate gamification framework that works well aligning with project objectives. It functioned as a guideline shaping desired behaviours, limiting the scope of needs for the ideal game design and website requirements.

On the other hand, a notable shortcoming of the project lies in the area of usability practices, which could have been executed more effectively. Although the e-commerce website's technical features and the Green-play gamification were successfully implemented, a more thorough usability testing strategy would have improved the user experience. Improving the usability procedures would have helped to improve the user experience and guarantee a more smooth and simple interaction for visitors to the website.

Despite the successful implementation of the Green-play gamification in the e-commerce website, certain challenges were encountered throughout the project. The foremost challenge was the constraint of limited time, which impacted the depth and extent of the gamification

strategy. The need to balance the ambitious goals of fostering sustainable shopping behaviours with the practical constraints of time posed a continuous challenge throughout the project lifecycle.

The use of object-oriented programming (OOP) to the gamification scenario presented another major challenge. Even though OOP provides a modular structure, it took considerable thought to match the finer points of gamification components inside this framework. Achieving a balance between sophistication and simplicity in the gamification scenario and the website's current object-oriented structure constituted the challenge. It took strategic decision-making, efficient time management, and an extensive understanding of object-oriented programming and gamification principles to overcome these obstacles. Notwithstanding these obstacles, the project overcame them to produce a gamified e-commerce platform that incorporates user engagement and sustainability objectives.

In future developments, the gamification strategy of the website is poised to evolve by incorporating additional more social game elements. As part of this improvement, a scoring system can be included, allowing users to use points for their accomplishments and interactions. Moreover, a leader board feature is planned, allowing users to gauge their performance against others on the platform, introducing a competitive dimension. The integration with social media channels is also on the horizon, that user can interact different players of the game by sharing their success and communicating. With the help of these calculated measures, website visitors should be able to engage in healthy competition and a more sociable and dynamic gaming experience.

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REFERENCES

Ahmad, S., Wong, K.Y., Tseng, M.L. and Wong, W.P., 2018. Sustainable product design and development: A review of tools, applications and research prospects. Resources, Conservation and Recycling, 132, pp.49-61.

Aparicio, M., Oliveira, T., Bacao, F., & Painho, M. (2019). Gamification: A key determinant of massive open online course (MOOC) success. *Information & Management, 56*(1), 39-54.

Alejandro García-Jurado, M., Torres-Jiménez, M., Leal-Rodríguez, A. L., & Castro-González, P. (2021). Does gamification engage users in online shopping? *Electronic Commerce Research and Applications, 48*, 101076.

Azmi, L. F., Ahmad, N., & Iahad, N. A. (2021). Gamification Elements in E-commerce – A Review. In *2021 International Congress of Advanced Technology and Engineering (ICOTEN)*, Taiz, Yemen, (pp. 1-5). doi: 10.1109/ICOTEN52080.2021.9493475

Batini, C., Ceri, S., & Navathe, S. (1992) "Conceptual Database Design: an Entity-Relationship Approach." Benjamin/Cummings Publishing, Redwood City, CA.

Batlle-Bayer, L., Bala, A., Lemaire, E., Albertí, J., García-Herrero, I., Aldaco, R., ... Fullana-i-Palmer, P. (2019). An energy- and nutrient-corrected functional unit to compare LCAs of diets. *Sci. Total Environ., 671*, 175–179.

Becker, K. (2021). What's the difference between gamification, serious games, educational games, and game-based learning? *Academia Letters, Article 209.* https://doi.org/10.20935/AL209

Behl, A., Jayawardena, N., Ishizaka, A., Gupta, M., & Shankar, A. (2022). Gamification and gigification: A multidimensional theoretical approach. *Journal of Business Research, 139*, 1378-1393.

Botte, B., Bakkes, S., & Veltkamp, R. (2020). Motivation in gamification: constructing a correlation between gamification achievements and self-determination theory. In *Games and Learning Alliance: 9th International Conference, GALA 2020, Laval, France, December 9–10, 2020, Proceedings 9* (pp. 157-166). Springer International Publishing.

Carlsson-Kanayama, A., Ekstrom, M., & Shanahan, H. (2003). Food and life cycle energy inputs: Consequences of diet and ways to increase efficiency. *Ecol. Econ., 44*, 293–307.

Chernbumroong, S., Sureephong, P., & Tongpaeng, Y. (2019). The Gamification Element Selection Method. In 2019 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT-NCON) (pp. 179-183). Nan, Thailand. doi: 10.1109/ECTI-NCON.2019.8692228.

Codish, D., & Ravid, G. (2014). Personality based gamification-Educational gamification for extroverts and introverts. In *Proceedings of the 9th CHAIS Conference for the Study of Innovation and Learning Technologies: Learning in the Technological Era* (Vol. 1, pp. 36-44). Ra'anana: The Open University of Israel.

Cugelman, B. (2013). Gamification: what it is and why it matters to digital health behavior change developers. *JMIR serious games, 1*(1), p.e3139.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: defining "gamification". In *Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments* (pp. 9-15).

Deterding, S., O'Hara, K., Sicart, M., Dixon, D., & Nacke, L. (2011). Gamification: Using game design elements in non-gaming contexts. Paper presented at *Conference on Human Factors in Computing Systems*, Vancouver, BC, Canada, May 7–12; 2425–28.

Diekmann, A., & Preisendörfer, P. (2003). Green and Greenback. The Behavioral Effects of Environmental Attitudes in Low-Cost and High-Cost Situations. *Ration. Soc., 15*, 441–472.

Domínguez, A., Saenz-de-Navarrete, J., De-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J.J. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers & education, 63*, pp.380-392.

Eisingerich, A. B., Marchand, A., Fritze, M. P., & Dong, L. (2019). Hook vs. hope: How to enhance customer engagement through gamification. *International Journal of Research in Marketing, 36*(2), 200-215.

European Commission, JRC, Institute for Prospective Technological Studies. (2006). *Seville, Spain, 2006*. Report EUR 22284 EN. Available online: http://ec.europa.eu/environment/ipp/pdf/eipro report.pdf (accessed on 2 December 2017).

Frost, R.D., Matta, V., & MacIvor, E. (2015). Assessing the efficacy of incorporating game dynamics in a learning management system. *Journal of Information Systems Education, 26*(1), pp.59-70.

Gagné, M., & Deci, E. L. (2005a). Self-determination theory and work motivation. *J Organization Behav, 26*, 331–362.

Glover, I. (2013). Play as you learn: gamification as a technique for motivating learners. In *Edmedia+ innovate learning* (pp. 1999–2008). Association for the Advancement of Computing in Education (AACE).

Goethe, O. (2019). *Gamification Mindset*, Human–Computer Interaction Series. https://doi.org/10.1007/978-3-030-11078-9_3

González-García, S., Esteve-Llorens, X., Moreira, M., Feijoo, G. (2018). Carbon footprint and nutritional quality of different human dietary choices. *Sci. Total Environ., 644*, 77–94.

Gupta, A. (2014). E-Commerce: Role of E-Commerce in today's business. *International Journal of Computing and Corporate Research, 4*(1), 1-8.

Hallstrom, E., Carlsson-Kanyama, A., Beorjesson, P. (2015). Environmental impact of dietary change: a systematic review. *J. Clean. Prod., 91*, 1–11.

Hajarian, M., & Hemmati, S. (2020, September). A gamified word of mouth recommendation system for increasing customer purchase. In *2020 4th International Conference on Smart City, Internet of Things and Applications (SCIOT)* (pp. 7-11). IEEE.

Hamari, J., Koivisto, J., & Sarsa, H. (2014, January). Does gamification work?--a literature review of empirical studies on gamification. In *2014 47th Hawaii international conference on system sciences* (pp. 3025-3034). IEEE.

Hamari, J., & Koivisto, J. (2013, June). Social Motivations To Use Gamification: An Empirical Study Of Gamifying Exercise. In *ECIS (Vol. 105, No. 5, pp. 18-19)*.

Hammerschall, U. (2019). A Gamification Framework for Long-Term Engagement in Education Based on Self Determination Theory and the Transtheoretical Model of Change. In *2019 IEEE Global Engineering Education Conference (EDUCON)*, Dubai, United Arab Emirates, (pp. 95-101).

Hossein Eslami, Trichy Krishnan. New sustainable product adoption: The role of economic and social factors, *Energy Policy, Volume 183*, 113824, 2023.

Huizinga, J. (1950). *Homo Ludens: a study of the play element in culture.* New York: Roy Publishers.

Hunicke, R., LeBlanc, M., & Zubek, R. (2004, July). MDA: A formal approach to game design and game research. In *Proceedings of the AAAI Workshop on Challenges in Game AI(Vol. 4, No. 1, p. 1722).*

Hussain, Z. M., & Sumari, P. (2016). WERT technique in requirements elicitation for web applications. In *2016 International Conference on Electronics, Information, and Communications (ICEIC)*, Danang, Vietnam (pp. 1-4). doi: 10.1109/ELINFOCOM.2016.7562976.

Johnson, D., Deterding, S., Kuhn, K. A., Staneva, A., Stoyanov, S., & Hides, L. (2016). Gamification for health and wellbeing: A systematic review of the literature. *Internet interventions, 6*, 89-106.

Julius, K., & Salo, J. (2013). Designing gamification. *Marketing*.

Juul, J. (2005). *Half-real: video games between real rules and fictional worlds.* MIT Press, Cambridge, Ma.

Kumar, G. A., & Kumar, A. R. (2018). "A Study On Employing Gamification Methods To Increase Customer Engagement In Digital Marketing". *International Journal of Engineering Development and Research (IJEDR), 6*(4), 560-564. Accessed: 23.03.2023. http://www.ijedr.org/papers/IJEDR1804100.pdf

Kuramoto, I., Ishibashi, T., Yamamoto, K., & Tsujino, Y. (2013). Stand up, heroes!: gamification for standing people on crowded public transportation. In *Design, User Experience, and Usability. Health, Learning, Playing, Cultural, and Cross-Cultural User Experience: Second International Conference, DUXU 2013, Held as Part of HCI International 2013, Las Vegas, NV, USA, July 21-26, 2013, Proceedings, Part II 2* (pp. 538-547). Springer Berlin Heidelberg.

Kušek, M., Dešić, S., & Gvozdanović, D. (2001). "UML Based Object-oriented Development: Experience with Inexperienced Developers." In: *6th International Conference on Telecommunications, June 13–15, 2001, Zagreb, Croatia*.

LeBlanc, M. (2004). Mechanics, dynamics, aesthetics: a formal approach to game design. Lecture at Northwestern University.
Marczewski, A. (2012). *Gamification: a simple introduction.*

Matenga, A., Crow, T., Walmsley, M., Luxton-Reilly, A., & Wuensche, B. (2018, April). Evaluation of the Implementation of a Timer in Gamified Programming Exercises. In *2018 International Conference on Learning and Teaching in Computing and Engineering (LaTICE)* (pp. 36-41). IEEE.

McGonigal, J. (2011). *Reality is broken: why games make us better and how they can change the world.* Penguin, New York.

Michael, D. R., & Chen, S. L. (2005). *Serious games: Games that educate, train, and inform.* Muska & Lipman/Premier-Trade.

Milanesi, M., Guercini, S., & Runfola, A. (2022). Let's play! Gamification as a marketing tool to deliver a digital luxury experience. *Electron Commer Res.* doi: 10.1007/s10660-021-09529-

Mohammadi, S. (2020). Gamification as a motivational tool: Extending Loyalty Programs with Gamification. doi: 10.13140/RG.2.2.16157.54241.

Mora, A., Riera, D., Gonzalez, C., & Arnedo-Moreno, J. (2015, September). A literature review of gamification design frameworks. In *2015 7th international conference on games and virtual worlds for serious applications (VS-Games)* (pp. 1-8). IEEE.

Mule, S.S., Waykar, Y., & Mahavidyalaya, S.V. (2015) "Role of USE CASE diagram in s/w development." *International Journal of Management and Economics*.

Nielsen, J. (1993). *Usability engineering*. Academic Press.

Nielsen, Jakob. "How to conduct a heuristic evaluation." *Nielsen Norman Group, 1*(1) (1995): 8.

Nielsen, Jakob. "Ten usability heuristics." (2005). https://www.nngroup.com/articles/ten-usability-heuristics/

Nora, K., Gefei, Z., & Mar, A. J. (2006). "ESCALONA Model transformations from requirements to web system design." In *Proceedings of the 6th international conference on Web engineering*.

Octalysis. (n.d.). Complete Gamification Framework. Retrieved from https://yukaichou.com/gamification-examples/octalysis-complete-gamification-framework/

Pant, A. (2015). Usability evaluation of an academic library website. *The Electronic Library, 33*(5), 896–915. https://doi.org/10.1108/EL-04-2014-0067

Paharia, R. (2013). *Loyalty 3.0: How to revolutionize customer and employee engagement with big data and gamification*.

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of general psychology, 14*(2), 154-166.

Raman, P. (2021). Examining the importance of gamification, social interaction and perceived enjoyment among young female online buyers in India. *Young Consumers, 22*(3), 387-412.

Rosa Yáñez Gómez, Daniel Cascado Caballero, & José-Luis Sevillano. (2014). Heuristic Evaluation on Mobile Interfaces: A New Checklist. https://doi.org/10.1155/2014/434326

Rubin, R. S., & Chisnell, D. (2008). *Handbook of usability testing: how to plan, design, and conduct effective tests*. John Wiley & Sons.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness.* Guilford publications.

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and emotion*, *30*, 344-360.

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. *International Journal of human-computer studies, 74*, 14-31.

Smil, V. (2013). Should We Eat Meat? Evolution and Consequences of Modern Carnivory; Wiley-Blackwell: Hoboken, NJ, USA.

Soh, P. Y., Heng, H. B., Selvachandran, G., Anh, L. Q., Chau, H. T. M., Son, L. H., ... & Varatharajan, R. (2020). Perception, acceptance and willingness of older adults in Malaysia

towards online shopping: a study using the UTAUT and IRT models. *Journal of ambient intelligence and humanized computing*, 1-13.

Song, I.Y., Evans, M., & Park, E.K. (1995) "A comparative analysis of entity-relationship diagrams." *Journal of Computer and Software Engineering*, *3*(4), pp. 427-459.

Springmann, M., Godfray, C., Rayner, M., & Scarborough, P. (2016). Analysis and valuation of the health and climate change cobenefits of dietary change. *Proc. Natl. Acad. Sci. USA, 113,* 4146–4151. [CrossRef] [PubMed]

Sundjaja, A. M., Savina, G., Yuli, & Hardianto, T. (2022). The Moderating Effect of Gamification on Loyalty Program Usage in Indonesian E-Commerce. *Binus Business Review, 13*(1), 19–29. doi: 10.21512/bbr.v13i1.6801

Sutton-Smith, B. (1997). *The ambiguity of play.* Cambridge, Mass.: Harvard University Press.

ÜÇTUG, F.G., GÜNAYDIN, D., HÜNKAR, B., & ÖNGELEN, C. (2020). Sustainable Production and Consumption.

Weber, C., & Matthews, S. (2008). Food-Miles and the Relative Climate Impacts of Food Choices in the United States. *Environ. Sci. Technol., 42*, 3508–3513.

Werbach, K., Hunter, D., & Dixon, W. (2012). *For the win: How game thinking can revolutionize your business* (Vol. 1). Philadelphia: Wharton digital press.

Wilson, K. A., Bedwell, W. L., Lazzara, E. H., Salas, E., Burke, C. S., Estock, J. L., ... & Conkey, C. (2009). Relationships between game attributes and learning outcomes: Review and research proposals. *Simulation & gaming, 40*(2), 217-266.

Xi, N., & Hamari, J. (2020). Does gamification affect brand engagement and equity? A study in online brand communities. *Journal of Business Research, 109*, 449-460.

Zichermann, G., & Linder, J. (2010). *Game-based marketing: Inspire customer loyalty through rewards, challenges, and contests.* John Wiley & Sons.

Zichermann, G., & Cunningham, C. (2011). *Gamification by Design— Implementing Game Mechanics in Web and Mobile Apps*. Sebastopol, CA: O'Reilly Media.