



Cities Going Green:

Application for the Development of a Green and Smart City



Application for the Development of a Green and Smart City

Project Result 3: Development of the Application



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1 Chapter 1: Introduction



"Cities Going Green" is an engaging and educational City Building game developed to raise awareness about environmental sustainability and encourage players to adopt eco-friendly practices. In this game, players embark on a journey to create and manage their own virtual cities, with the ultimate goal of achieving high "Green" values, such as Air Quality, Recycling, Water Quality, and Life Quality.

This document serves as a comprehensive guide to the development and gameplay of "Cities Going Green." It aims to provide a clear understanding of the game's mechanics, features, and educational aspects. Game developers, stakeholders, and players alike will find valuable insights into the design philosophy, objectives, and the positive impact it can have on fostering eco-consciousness.

Beyond entertainment, "Cities Going Green" stands as an educational tool to instill environmental consciousness in players. By simulating real-life city planning scenarios, the game imparts essential knowledge about eco-friendly practices, resource management, and sustainable decision-making. The immersive experience encourages players to apply the acquired knowledge in their daily lives, fostering a sense of responsibility towards creating a greener and more sustainable world.





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2 Chapter 2: Game Concept and Mechanics

"Cities Going Green" revolves around the engaging city-building genre, where players take on the role of city planners with the goal of developing a sustainable metropolis. As players progress through the game, they must strategically design and expand their city, considering various factors that contribute to its overall "Green" values.

The game revolves around four essential "Green" values, representing critical aspects of sustainable urban development and environmental well-being. Each "Green" value reflects the city's performance in a specific area, and players' decisions and actions significantly impact these values throughout the gameplay.

Air Quality measures the level of pollution and the overall purity of the city's air. Players can enhance Air Quality by adopting eco-friendly practices, such as:

- Investing in renewable energy sources like solar panel parks and wind energy parks to reduce dependence on fossil fuels and lower harmful emissions.
- Encouraging the use of bicycles and public transportation to reduce vehicular emissions and traffic congestion.
- Implementing strict pollution control measures for industrial areas to minimize harmful pollutants.

As players improve Air Quality, the city becomes a healthier and more breathable environment, fostering better living conditions for its residents.

Recycling value reflects the city's commitment to waste reduction and recycling practices. Players can boost Recycling by implementing the following:

- Establishing recycling plants to efficiently process and reutilize waste materials.
- Promoting the use of recycle and compost bins throughout the city to encourage responsible waste separation.
- Educating citizens about the benefits of recycling and its positive impact on the environment.

By increasing Recycling, players contribute to a more sustainable waste management system, reducing the city's environmental footprint and promoting circular economies.

Water Quality assesses the health of the city's water resources and the effectiveness of its water management systems. To enhance Water Quality, players can focus on:

- Implementing advanced water treatment facilities to ensure clean and safe drinking water.
- Encouraging responsible water consumption and promoting water-saving practices.





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- Protecting natural water sources and reducing pollution to maintain a healthy aquatic ecosystem.

By improving Water Quality, players contribute to the preservation of precious water resources and the well-being of aquatic life within the city.

Life Quality reflects the overall well-being and happiness of the city's residents. Players can enhance Life Quality by:

- Increasing green spaces and parks to provide recreational areas and promote a healthier lifestyle.
- Investing in healthcare facilities and services to ensure the well-being of citizens.
- Promoting eco-conscious campaigns and initiatives to foster a sense of community and civic engagement.

By improving Life Quality, players create a more vibrant and harmonious urban environment, where residents can thrive and enjoy a higher quality of life.

2.1 Buildings

In "Cities Going Green", players have access to specific building slots within their city, providing opportunities to construct a variety of eco-friendly structures. Each building comes with unique attributes that significantly impact the city's "Green" values. As players strategically place these





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buildings, they wield the power to influence crucial factors, such as Air Quality, Recycling, Water Quality, and Life Quality, thus shaping the course of their city's growth.



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Possible buildings that players can choose from include:

- **Solar Panel Park:** Constructing solar panel parks allows players to harness the power of the sun, generating clean and renewable energy to supply the city's electricity needs. Embracing solar energy helps reduce the city's carbon footprint and enhances the overall Air Quality.



- **Wind Energy Park:** Building wind energy parks enables players to harness the natural power of wind to produce clean electricity. By investing in wind energy, players contribute to sustainable energy production, positively impacting the city's Air Quality.



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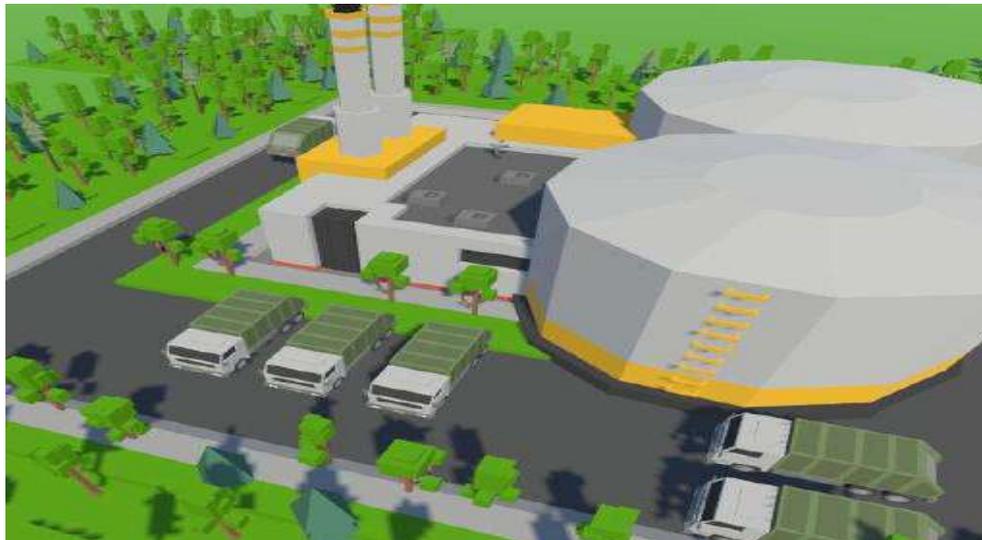
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- **Waste Management Plant:** Establishing waste management plants ensures efficient handling and disposal of the city's waste. Proper waste management reduces pollution, enhances Recycling practices, and ultimately improves the city's overall environmental health.



- **Recycling Plant:** Investing in recycling plants allows players to recycle and reprocess waste materials, reducing the amount of waste sent to landfills. Effective recycling boosts the city's Recycling value and promotes a circular economy, minimizing resource consumption.





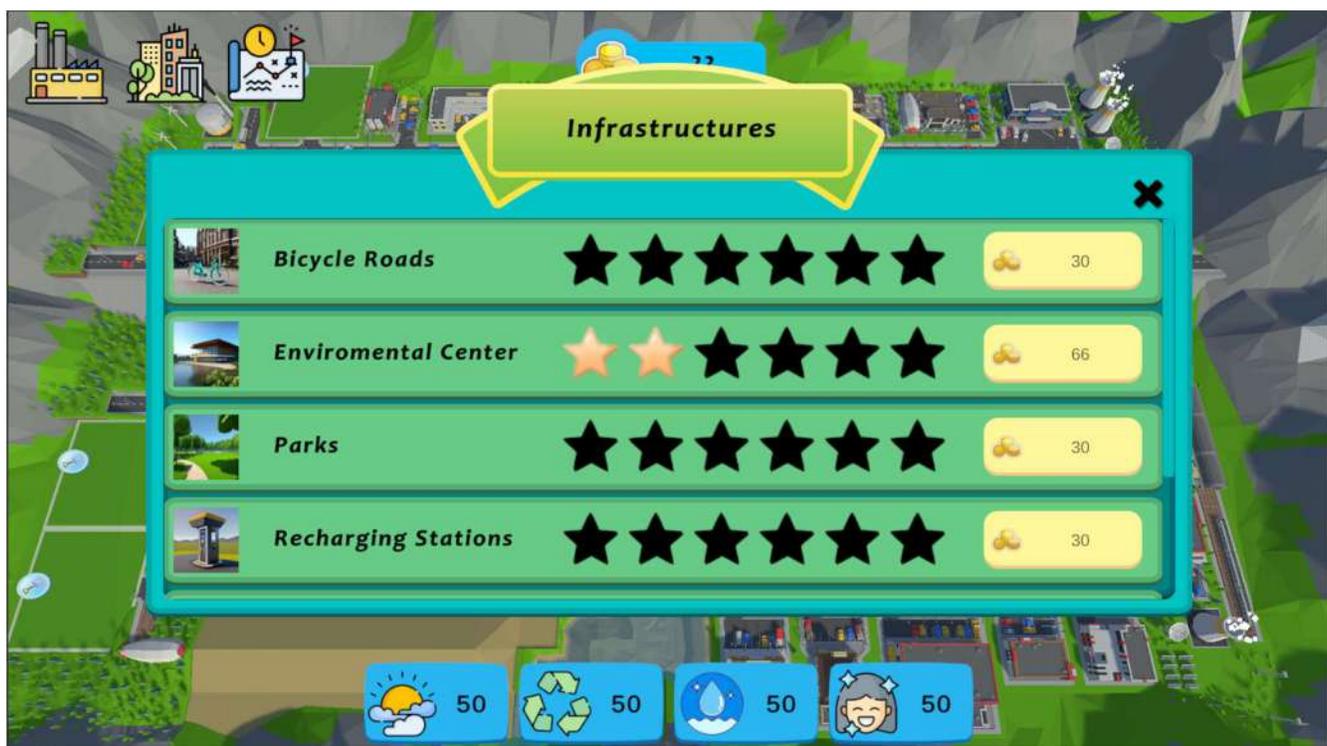
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As players make informed decisions about which buildings to construct and where to place them, they play a vital role in determining the city's environmental direction and its residents' quality of life. By striking the right balance and aligning with eco-friendly practices, players can lead their cities towards a greener and more sustainable future.

2.2 Infrastructures

In "Cities Going Green," players have the opportunity to upgrade existing city infrastructures, elevating their efficiency and eco-friendliness to enhance the overall sustainability of their virtual metropolis. Upgrades encompass a range of eco-conscious options, from promoting green transportation to implementing advanced waste management systems. By making these upgrades, players actively contribute to their city's "Green" values and foster a more environmentally responsible urban environment.



Possible city infrastructure upgrades include:

- **Bicycle Roads:** Investing in bicycle roads and promoting cycling as a viable means of transportation reduces carbon emissions and congestion. Bicycle-friendly infrastructure boosts Air Quality and encourages a healthier, more sustainable mode of travel.



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- **Vehicle Charging Stations:** Integrating vehicle charging stations for electric cars encourages the adoption of clean transportation options. By supporting electric vehicles, players contribute to improved Air Quality and a reduced reliance on fossil fuels.
- **Recycle/Compost Bins:** Implementing a comprehensive system of recycle and compost bins across the city enables efficient waste separation and recycling. Responsible waste management elevates the city's Recycling value and minimizes landfill waste.
- **Parks:** Expanding green spaces and parks within the city not only enhances the Life Quality for its residents but also contributes to improved Air Quality and biodiversity.
- **Environmental Center:** Establishing an Environmental Center serves as a hub for eco-awareness and educational initiatives. The center facilitates environmental campaigns, workshops, and resources for the city's residents, fostering a more environmentally conscious community.
- **Trees/Plants:** Planting trees and vegetation throughout the city helps combat air pollution, provide natural cooling, and promote a greener urban environment, positively impacting Air Quality and Life Quality.

2.3 Campaigns

In "Cities Going Green," players can initiate and run various awareness campaigns to educate and engage their city's residents in environmentally responsible behaviors. These campaigns play a pivotal role in raising awareness about the importance of sustainable practices and inspire citizens to actively participate in making a positive impact on the environment. Successful campaigns lead to a more informed and engaged community, ultimately contributing to increased "Green" values across the city.

Possible campaign options include:

- **Car Withdrawal:** Encourage residents to reduce their dependence on personal vehicles by promoting alternative transportation options like public transit, cycling, or carpooling. This campaign aims to reduce traffic congestion and lower carbon emissions, positively impacting Air Quality.
- **Bicycle Funding:** Advocate for the expansion of cycling infrastructure and incentives to encourage residents to use bicycles for commuting. Supporting cycling as a green transportation alternative can improve Air Quality and promote a healthier lifestyle.





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- **Solar Panel Funding:** Raise funds and awareness to support the installation of solar panels on residential and public buildings. Solar energy adoption contributes to renewable energy generation and lowers the city's carbon footprint.
- **Energy Monitoring Systems:** Educate residents about energy conservation by implementing smart energy monitoring systems. Encouraging responsible energy usage can lead to significant reductions in energy consumption and, subsequently, lower greenhouse gas emissions.
- **Saving Water:** Promote water conservation practices, such as fixing leaks, using water-efficient appliances, and adopting responsible watering habits. Conserving water resources enhances the city's Water Quality and sustainability.
- **Remote Work Promotion:** Advocate for remote work options to reduce commuting and the associated carbon emissions. Promoting remote work can also lead to a better work-life balance for residents.
- **Recycling Promotion:** Raise awareness about the benefits of recycling and the proper sorting of recyclable materials. Increased recycling rates contribute to better Recycling values and minimize waste pollution.
- **Zero Waste Promotion:** Encourage the adoption of a zero-waste lifestyle, focusing on reducing waste generation and maximizing recycling and composting efforts.
- **Stop Littering:** Emphasize the importance of not littering and responsible waste disposal. Encouraging clean public spaces fosters a sense of pride in the community and contributes to improved Life Quality.





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2.4 Intervals

The gameplay revolves around distinct intervals that dictate the progression and development of the player's city. These intervals are defined as specific periods of time, such as days, weeks, months, or game rounds. At the beginning of each interval, the player is presented with the opportunity to manage and upgrade their city. Throughout the interval, players are given a certain amount of credits, this allows players to invest strategically in various city upgrades, ranging from building new structures to enhancing existing infrastructure or starting campaigns.





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2.5 Score Table

The following table depicts the effect of the user decisions on the city values.

	Cost	Air Quality	Recycling	Water Quality	Life Quality
Buildings					
Solar Panel Park	120	140	80	60	80
Wind Energy Park	120	150	60	50	100
Waste Management Plant	120	75	150	45	90
Recycling Plant	120	50	200	50	60
Infrastructures					
Bicycle roads	120	108	72	36	144
Vehicle charging stations	120	150	60	50	100
Recycle/Compost bins	120	70	120	80	90
Parks	120	110	70	90	90
Environmental Center	120	90	90	90	90
Trees/Plants	120	120	60	60	120
Campaigns					
Car withdrawal	120	150	100	30	80
Bicycle funding	120	120	40	40	160
Solar panel funding	120	120	50	80	110
Energy monitoring systems	120	90	80	60	130
Saving water	120	90	80	130	60
Remote work promotion	120	90	30	50	190
Recycling promotion	120	50	200	50	60
Zero waste promotion	120	100	120	80	60
Stop littering	120	90	70	80	120
MAX VALUE (1 building)		1963	1732	1211	1934





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3 Back-end Platform for school implementation

In order the game to be used in schools, a back-end platform has been used in order teacher and student accounts to be created for these schools. The back-end is available at <http://cities.omegatech.gr/> and requires first a headmaster account for each school. The headmaster can add School Classes, Teachers and Students.

3.1 Adding classes.

The headmaster has to assign a name to each class.

The screenshot shows the 'create' form in the back-end platform. The form has a 'Name' field containing 'My class name', a 'save' button, and a 'savecontinue' button. A red circle highlights the 'Name' field and a red arrow points to the 'save' button.

The class is added to the schools' list of classes.

The screenshot shows the 'list' view in the back-end platform. A table shows the class 'My class name' added to the list. A red circle highlights the table row.

Name	Academic Year	school	edit	view
My class name	2023-2024	Escola Sant Josep		





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3.2 Adding the Teachers.

The headmaster has to assign a username and a password to each teacher. There is an automated prefix for each username (e.g. s1004-MyTeacher)

The screenshot shows a web interface for creating a new teacher. The page title is 'create'. There is a 'back to list' button at the top. The 'username' field is pre-filled with 's1004- MyTeacher' and is circled in red. The 'password' field is empty. Below the fields are two buttons: 'save' and 'save continue'. A red arrow points to the 'save' button.

The teacher is added in the list. Then the headmaster should “assign” a class to this teacher.

The screenshot shows a 'list' view of teachers. There are three green buttons at the top: 'created', 'editprofile', and 'assignworkingschool'. Below them is a 'create' button. There is a search bar with 'searchusername' and 'searchclassholder' fields. Below the search bar is a table with columns: 'access', 'username', 'roles', and 'assignedschoolclasses'. The first row has a green checkmark in the 'access' column, 's1004-MyTeacher' in the 'username' column (circled in red), 'SchoolTeacher' in the 'roles' column, and 'none' in the 'assignedschoolclasses' column. To the right of the row are two buttons: 'edit' and 'assign' (circled in red).

The headmaster selects the class from the list of school classes.

The screenshot shows a 'selectschoolclass' form. It has a dropdown menu with the text 'My class name [2023-2024]'. Below the dropdown is a 'save' button.

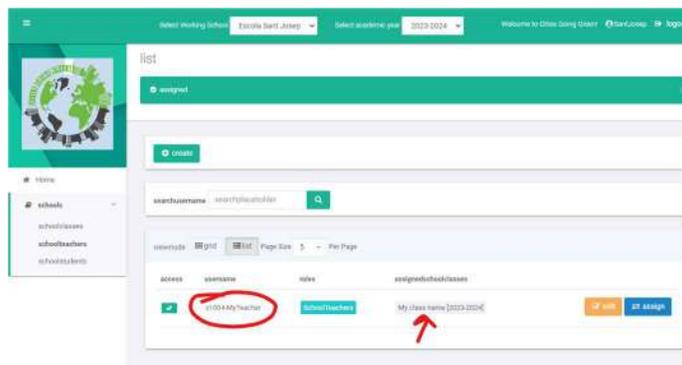
Finally, the teacher is assigned to this class.





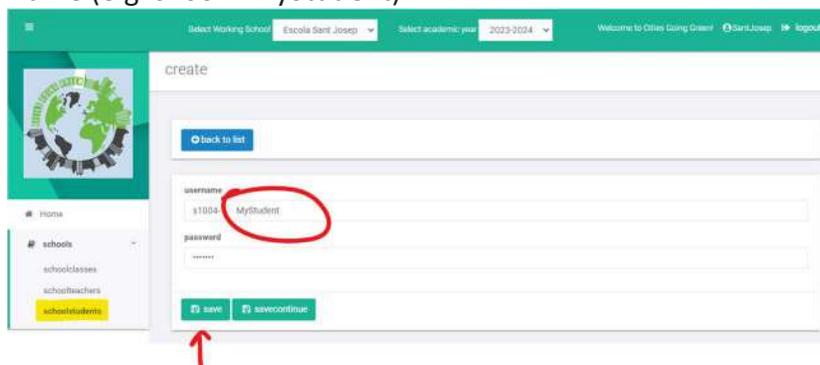
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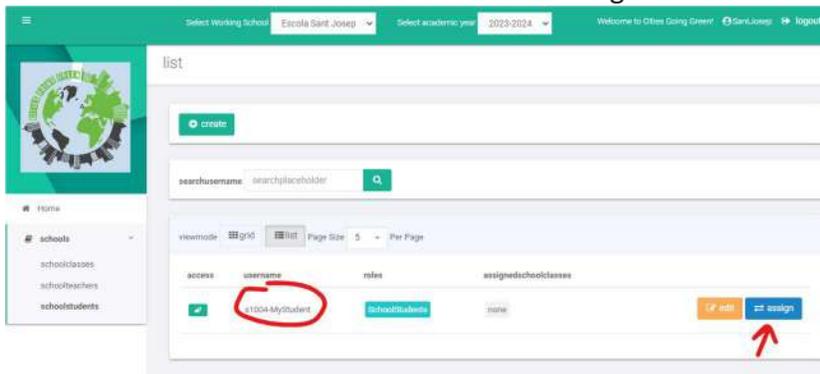


3.3 Adding the Students.

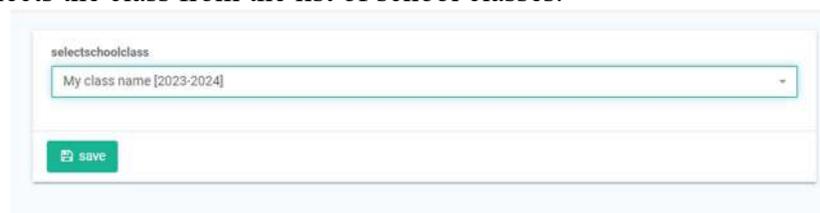
The headmaster has to assign a username and a password to each student. There is an automated prefix for each username (e.g. s1004- MyStudent)



The teacher is added in the list. Then the headmaster should “assign” a class to this student.



The headmaster selects the class from the list of school classes.



Finally, the student is assigned to this class.



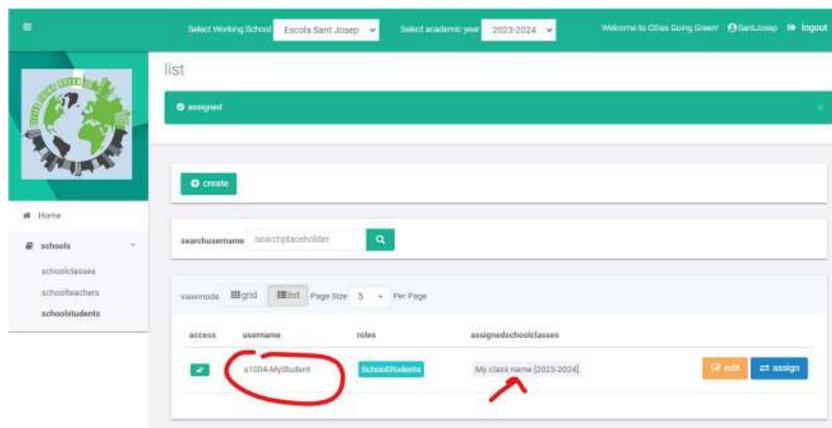
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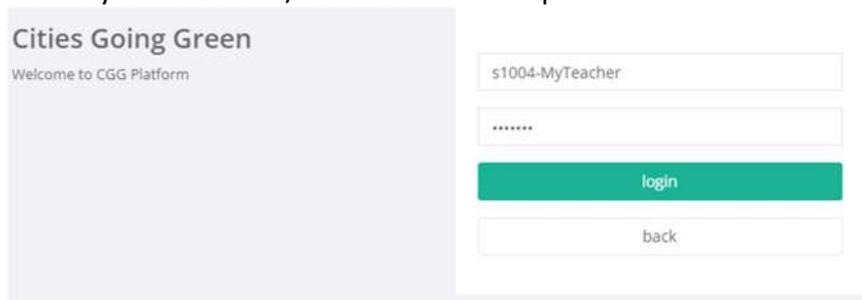
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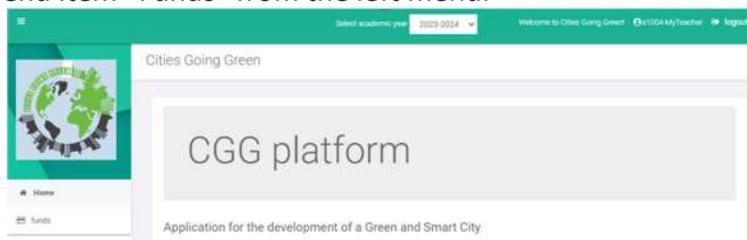


3.4 Adding Funds to students.

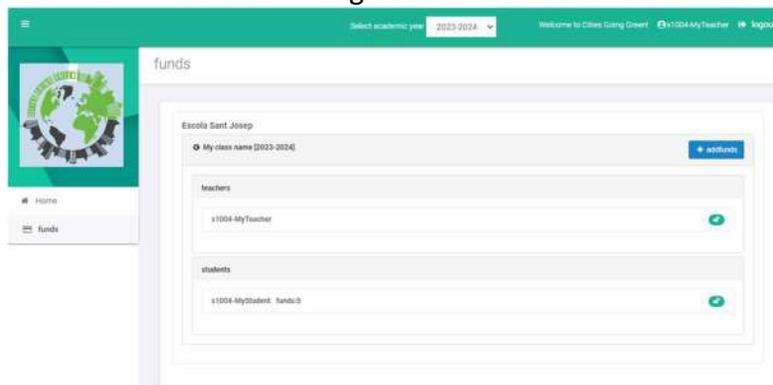
The back-end gives the option to the teacher to decide when to give extra funds to his/her students. The Teacher logs in the system with his/her username and password.



The teacher selects menu item “Funds” from the left menu.



The teacher clicks “Add funds” and 50 coins are added to each student of the class. Can click add funds many times to reach the desired amount given to the students.



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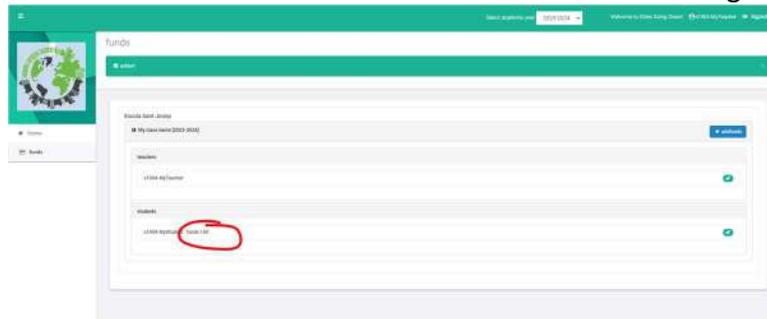
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Finally, the funds are added to each student account and are available in the game.



4 IoT integration

An IoT device was used to allow students to interact with the game through this device. The idea implemented to showcase this integration was the students to be able to change the weather in all students' cities of the same class, using the IoT device.

M5 STACK BASIC (ESP32) was used that it is a cost-effective entry-level main controller for IoT applications.



M5stack was programmed to Interact with the weather of the game by pressing the buttons (Button 1: Sunny, Button 2: Rainy, Button 3: Snowy).



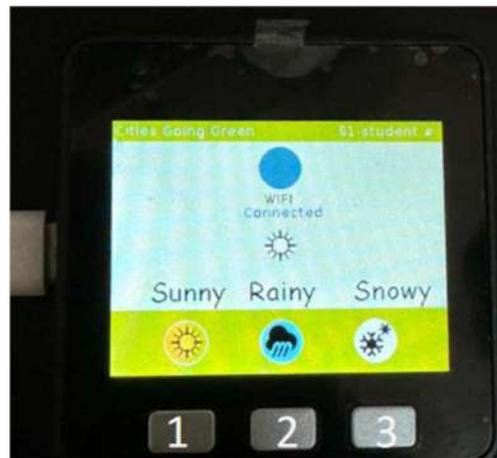
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In annex I, there is a full manual for how the IoT device can be used.

5 The Game

The game for schools requires the login and password of the student. The game is available in all languages. The user has to select the relevant flag.



After successful login an overview of the city appears.



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The first button on the left is for adding buildings in the city.



To add a building the player should click on a specific arrow in the map. A list of available buildings and the price for each upgrade appear.



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Selecting a building, information on how this building will affect city's values becomes available.



Selecting the price, the building is placed in the selected space and the values of the city change. Since this is the first building placed, the new city values match the value changes of the building placed.



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The second button from the left has to do with infrastructures. The player can select a new or to upgrade an existing infrastructure of the city.



The same way, each selection affects city values.



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The third button from the left, has to do with campaigns.



A campaign has also positive influence on one or more city values.



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While playing the player has to acquire some badges. Based on specific goals of each class lesson the teacher can ask the students to achieve specific badges.



There is also a ranking list, showing who of the students have achieved the best score in each city value.



A free version of the game is also available on Google Play.

<https://play.google.com/store/apps/details?id=com.OmegaTechnologies.CitiesGoingGreen>



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Google Play Παιχνίδια Εφαρμογές Ταινίες Βιβλία Παιδικά

Cities Going Green

OmegaTechnology

50+ Λήψεις Έγκρ. από εκπαιδευτ. PEGI 3

Εγκατάσταση

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Υποστήριξη εφαρμογής

Περισσότερα από OmegaTechnology



6 Technology

1. For the realization of "Cities Going Green," the development team chose the Unity engine as the platform for the game development. Unity provides a robust and user-friendly development environment, facilitating the creation, iteration, and implementation of game mechanics with efficiency.



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