GoGarbage

Event	Coding & Programming
Names of Competitors	Mahin Patel, Vynavin Vinod, Kavya Patel
School	Harold M. Brathwaite SS
City	Brampton
Date	February 23, 2025

Table of Contents

Introduction

Problem

According to Ocean Conservancy & National Geographic, every year approximately 8 million metric tons of plastic waste enter the ocean, adding to the estimated 150 million metric tons already circulating in marine environments. Evidently, it is more important than ever to address this issue. Littering has a profound impact on the health of animals and humans. Marine-life is dying to plastics more than ever before. The natural decomposition of the garbage we litter is immensely contributing to global warming. If we don't stop now, we may be facing a future where our ecosystems are irreparably damaged, and our communities are hurt beyond restoration.

Another issue that has recently come to life is the increasing antisocialism in our city. Everyone's always on their phones talking to each other, all day, every day. Students and adults alike are talking to each other less, especially if they don't personally know them. Studies show it's proven to lower overall grades, and decrease attention span. If everyone on the planet is like this in the future, imagine the impact it would have on society?

These two problems are no random issues, but two interconnected complications. How do you expect a society that neglects each other to care for the environment? With the recent rise of social media, people are chronically in their houses. What makes you believe they'll leave their house to care for our beloved planet if they aren't rewarded?

Solution

As a way to address this issue, we, Kavya, Mahin, and Vynavin, have decided to create an engaging app that helps remove waste within local communities, while being interactive and rewarding. Our app lets you help the planet, play games, win rewards, and get out of the house all at once.

Our new and innovative crypto design is the forefront of technological in-game currency, which creates a sense of community and economy. $WASTE is a crypto-based market system which enables users to gain money while cleaning up our community. Players can trade, use, and buy this currency to take advantage of the market value of $WASTE, which is fueled by others purchasing our crypto, instead of us investing money from our own pockets.

Concept

The Idea

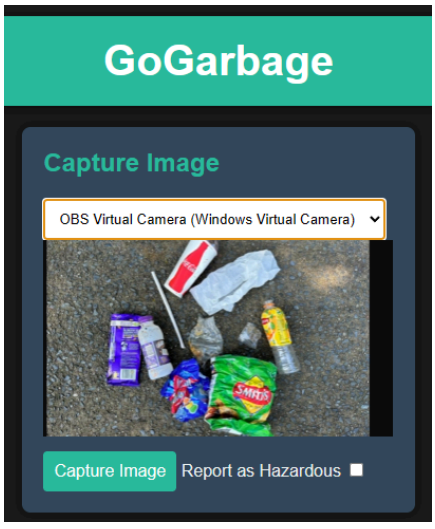
We wanted to build a functional and fun method to help the environment, while simultaneously distributing rewards. GoGarbage is an innovative, and cutting-edge method of distributing our own cryptocurrency as a reward based on the users requirements, all the while keeping garbage off our streets. It's the first Web3 project to save the environment!

The Inspiration

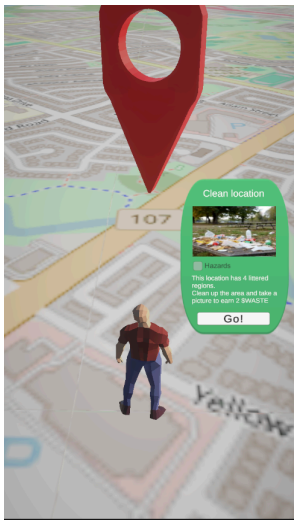
We were inspired notably by Pokemon Go, SweatCoin, and Mr. Beast's #teamseas and #teamtrees initiatives. We decided to combine key aspects of these ideas, and many other functions, to create GoGarbage. A major factor of our app is the real-time location tracker, which visually displays onto the app itself. This was taken from Pokemon Go, being a core function in the app. Another major factor of the app is our blockchain reward system, $WASTE. It allows us to reward users with real money and create an economy without putting in money ourselves.

How It Works

When a person sees trash and has too much to clean up by themselves, they report it to the app (image 1), and it gets sent across the database to many other users. An innovative and interactive map system shows this crowdsourced to dedicated and nearby users to clean up trash (Image 2). At the location, trash is proofed as cleaned by an AI system to detect it has been picked up, and thrown away. After proof has been shown, the user gets rewarded and can either change their reward into profits or spend it on in-game rewards.



(Image 1)



(Image 2)

Tech Stack

Databases

GoGarbage data is stored in three places. We used cloud based storage providers for their fast and easy access through the python requests library.

1. Locally on the users device using Unity Playerprefs (Player key)
2. A table on Supabase (Per user and leaderboard data)
    - This is our main storage for anything non-blockchain related. It stores things like rewards, reports, xp, unclaimed coins, and login credentials
3. In the user's MetaMask wallet (Claimed coins and upcoming NFT pets)

Main Game

The main app was created in the Unity engine using C#.

Map: Once users are logged in, they will be placed on a map using their real location and a customizable avatar. The player's location is found using Unity's built-in "Input.Location" function. The location is then passed to openstreetmap's tiles API where it collects map texture data within a set perimeter. This is then placed on planes arranged in a set grid size for efficient performance. After the map has been fully loaded, the MapLoader.cs script uses UnityEngine.Networking and WebRequest to call the Supabase API and collect nearby map marker coordinates and place them accordingly on the map. This is done every 9 seconds to avoid rate limits

MapLoader.cs:

```
IEnumerator LoadTile(int tileX, int tileY, GameObject tileObj)
{
    // URL to fetch the tile texture
    string url = $"https://tile.openstreetmap.org/{zoom}/{tileX}/{tileY}.png";
    UnityWebRequest www = UnityWebRequestTexture.GetTexture(url);
    yield return www.SendWebRequest();

    if (www.result == UnityWebRequest.Result.Success)
    {
        // Apply the texture to the tile
        Texture2D texture = DownloadHandlerTexture.GetContent(www);
        tileObj.GetComponent<Renderer>().material = new Material(Shader.Find("Universal Render Pipeline/Unlit"))
        {
            mainTexture = texture
        };
    }
    else
    {
        // Display an error message if the tile could not be loaded
        errorText?.SetText($"Error downloading tile {tileX}/{tileY}: {www.error}\n");
    }
}
```

```
IEnumerator UpdateMapPeriodically()
{
    while (true)
    {
        // Get the device's real-time location
        if (Input.location.status == LocationServiceStatus.Running)
        {
            latitude = Input.location.lastData.latitude;
            longitude = Input.location.lastData.longitude;
        }
        else
        {
            errorText?.SetText("Unable to determine device location.");
        }

        errorText?.SetText(""); // Clear any previous error messages
        UpdateAllTiles(); // Update all the tiles and markers
        yield return new WaitForSeconds(9f); // Wait for 9 seconds before updating again
    }
}
```

Communication with Flask API: C#, while versatile, is not easy to implement with web services. To simplify the development process, we created an API in python to handle retrieving and sending data to Supabase. We used the same unity networking package to bring JSON formatted data to and from the Python Flask API highlighted in the next section. This also ensures all requests to edit data have been properly validated and cheating is extremely difficult.

Example of calling API from Unity (TrashpassManager.cs - Loadxp()):

```
Setkey = PlayerPrefs.GetString(ENCRYPT_PREF_KEY);
KeyData keyData = new KeyData { key = Setkey };
Debug.Log("Key data: " + keyData.key);
string json = JsonUtility.ToJson(keyData);
byte[] bodyRaw = Encoding.UTF8.GetBytes(json);

Debug.Log("Sending key for validation: " + Setkey);
Debug.Log("JSON payload: " + json);


UnityWebRequest request = new UnityWebRequest("http://10.0.0.225:5002/get-xp", "POST");
request.uploadHandler = new UploadHandlerRaw(bodyRaw);
request.downloadHandler = new DownloadHandlerBuffer();
request.SetRequestHeader("Content-Type", "application/json");

yield return request.SendWebRequest();
```

A majority of the functions from the GoGarbage app are linked to the website to ensure common functionality across all devices.

Website

The GoGarbage website was built in Python Flask supported by HTML, CSS, and JavaScript. It has multiple routes for different pages and API calls. Below are details for specific systems.

Unity + Flask API: Unity sends requests to the python program using simple API calls. To support these API calls, we used Flask. There is a wide variety of routes that can be called, such as key verification, or loading player statistics. We opted to add this python middleman to ensure that all awarding, verification, and data handling is done server side to avoid undesirable modding to player data.

Login systems: As per the requirements, the GoGarbage website uses both a standard email + password system and a login with google system (third party). Additionally, when redeeming your crypto funds, the user will have to use a metamask or similar supported wallet. The user also gets a unique identifier ‘key’ for easy login to the mobile app. Storage and verification of user details can be discovered in more depth in the ‘Security’ section of the report.

AI systems

GoGarbage has purpose-tuned and seamless AI to ensure the best user experience. One example is for detecting litter in reported images. We used a pre-trained litter detection AI to verify garbage cleanup to maximise efficiency of time and resources. We opted to run a yolov8 powered detection system originally trained by Jeremy-rico on Github and fine-tuned it with a custom dataset. We used that model by importing it into our run and infer script. Here we can pass any png or jpg formatted image and return the detected garbage and the amount. Users can see visual highlights of where the garbage has been detected. In the future we would like to train a more advanced model with a wider variety of commonly littered items and add a system to also detect similarity between locations to verify the garbage has been accurately cleaned in the right area.

Web3 Technology

It took a lot of discussion to agree upon a good way to reward users. One thing we did agree upon, is that pure gamification would not work for a large task like mass garbage cleanup. Instead, we focused on finding sustainable and practical ways to reward our users. Our major inspiration was ‘SweatCoin’ , an app that encourages users to walk by giving them some crypto and other rewards in exchange.

Our coin: We decided to take a similar approach to Sweatcoin and launch our own cryptocurrency: $WASTE. The coin was deployed on the Avalanche Fuji Testnet using thirdweb, but we plan to later migrate it to Avalanche C-Chain (mainnet). There, we would be able to give our coin a real world value, providing more user incentive. Coins, before they are claimed, are stored in supabase. Then, users can go to the redeem page to connect their metamask wallet and redeem their coins. These coins are distributed through a central wallet with a pre-set balance. Once this wallet is exhausted, we can trigger a burn event.

NFT Pets: The current pets system only uses Unity PlayerPrefs and is not linked with the users account or Metamask wallet. In the TrashpassManager.cs file, structure for pets being linked to ownership of certain “Pet key” NFT’s. These will be powered by thirdweb’s Unity SDK and be tradable via opensea. This would lead to full migration to a blockchain based currency system and economy.

Security

Login Systems: Users are first prompted to get a key after opening the app for the first time. There, they are prompted to create an account using their email and password. This then lets them receive a key. User passwords are hashed and stored in a database with RLS (Disabled for demonstration). The Third Party single sign-on aspect comes from the option to connect your Metamask wallet to manage your account and redeem your $WASTE funds.

Server-side verification: All data being stored in the database goes through verification using the key and the hashed user details. This way, data cannot be written or modified without appropriate authorization. This check is done completely server side to ensure code cannot be tampered with. Finally, image recognition and garbage reporting is also done on the server in order to reliably identify garbage, instead of allowing the user to input.

Decentralized technology: One of the major perks of using Web3 technology is decentralization. Once something is stored in a user's wallet, nobody can access it except for that specific user, not even the GoGarbage team. This is done by taking advantage of the Avalanche network to verify every transaction being made.

Advantages and Limitations

Advantages

This system conveys an open mapping system with high quality visuals, displaying accurate real-time information with up to 9 seconds of accuracy. This creates an engaging environment, and refreshes relevant app information consistently to be up-to-date on latest clean-up sites.

We also have a precise AI algorithm built using YoloV8, which offers a recognition system that can easily detect garbage and ignore unnecessary details, providing optimised performance.

A huge factor for this app is its collaborative integration. Players can report the app to others, and then others work together to clean up the area. With full completion of the area, many rewards are given out to the players. This increases socialism as there is nothing to do except converse while cleaning up, reaching one of GoGarbage's main goals.

The GoGarbage pet and buffs system is an intuitive design which gives the players an emotional connection to their character. This allows players to feel more connected to the game, and have a feeling that their character resembles them.

Limitations

The app does not work as effectively in low density populations compared to higher density metropolitan areas because of less people using the app, making there less recognition nearby. Although, this can also have its upsides, such as higher potential earnings for the individual, and finding areas left unchecked with high trash levels.

A primary defect in AI is that it can always make mistakes, and that's indifferent toward our AI software. Although it is highly accurate, it may provide some level of inaccuracy because of many factors such as foreign objects, low light levels, e.t.c. We plan on fixing this problem in the future using full camera capabilities, a larger yet more efficient database, and most importantly better AI training methods to create a much better system.

Another limitation is that our rewards system may not work on older phones as it uses Web3. In the future, we can consider adding Web3 free alternatives such as gift-cards or in-game items.

A focal point of the app's current limitations are that it does not include weather in its systems. It can be difficult to coordinate to the player in extreme conditions, and does not warn of incoming bad weather. We plan on implementing this as a future update, to fix this issue and have an interactive climate system to improve quality of life on the map itself.

Program Implementation Timelines

Future Feature Timeline

We plan to add many features in the future of the development of this app. Namely, quality of life features which vastly improve overall user experience. Features such as:

- Live-updating and interactive weather (1 month in): Visually displays weather shifts on map
- Trash report categories (1-2 weeks in) : Make it easier to find different areas of trash, such as beaches, piles, e.t.c.
- Special items (3-4 months, continual updates) : Boosts or clues in relation with events and sponsorships
- Limited time events (Major celebrations, christmas, halloween, e.t.c.) : Events that last over time to give better items

... and much more. These features will ensure user retention by making the game fresh every update, ensuring the app can continue to perform long after its creation.

Another major timeline implementation would be extra features, and a monthly updating trash pass. The trash pass would add fresh content, such as:

- Character customization (1-3 months, continual updates) : Change the appearance, clothes, and emotes of your character
- New pet abilities (2-3 months) : Have different effects and boosts on your pet, such as increased $WASTE gain
- Statistics boosts

The trash pass would also help increase the market value of $WASTE, increasing user gains, and become a repeating cycle of profit for both parties. This strategy is beneficial toward gaining player count, and expanding on our current market.

Marketing and Advertising

Our goal is to implement strategic marketing to boost player count, and increase recognisability of the app. If more users are intrigued by the game, more reports and nearby helpers are recognised in the game and brings recognisability to the GOGARBAGE brand. With more recognition, it will foster trust in GoGarbage and help expand the company, bringing more quality updates and patches to users that expect nothing but the best. GoGarbage would be primarily targeted toward a wide array of audiences, such as youth wanting to help out the planet and earn some cash to spend on themselves, or adults that need a side job and are climate advocates.

Partnerships and Collaborations

GoGarbage plans to have many collaborations with various companies, to bring future developments which brings users' favourite brands to the app. This can have many implementations, such as brand boosts. Brand boosts would be an innovative method to give easter eggs and rewards scattered throughout the app in various systems such as the app, or our pending loot-box system in the form of brand products. Not only would it bring events, but expand liquidity through sponsorship, and help support app maintenance as well as other events. In the future, GoGarbage hopes to collaborate with non-profit environmental organizations like the WWF, Greenpeace, and Rainforest Alliance.

Future Plans

Diverse Rewards System

To keep users engaged and motivated, GoGarbage hopes to diversify its rewards system, changing it from only $WASTE and in-game coins to something that feels “more rewarding”, making every reward more exciting than the last. We plan on doing this by:

1. Character Models: By implementing a variety of different character models, users are able to express themselves, whether they decide to make the model something similar to themselves or anything else. It gives users a choice in how they should be displayed in the app, giving players personal satisfaction.
2. Extended Trashpass: A longer trashpass with more rewards would prompt users to “grind” the game more. For example, a trashpass with 100 levels instead of 10 would encourage users to play the game more to obtain more xp, in turn attaining more rewards.
3. Item Shop and Loot Boxes: An item shop filled with a variety of different rewards that refresh daily would be the perfect addition to this app. This feature ensures users always have something new and exciting to look forward to everyday, encouraging them to keep playing and get in-game currency to spend it in the shop. Loot Boxes would also be available in the shop. They would have rewards organized by rarity, with common rewards being the easiest to get while mythic rewards being the hardest. This sense of “unknowingness” and mystery keeps users on the edge of their seat. It also makes users continue to spend their in-game currency on loot boxes hoping they would be lucky enough to obtain a mythical reward.

Increased Customization

To give users more control over their account and online identity, we plan on giving players more options and choices over customization. This allows users’ GoGarbage accounts to reflect themselves in a variety of ways, ensuring they feel included in our community. We plan on increasing customization by adding:

1. Character Customization: As previously mentioned, character customization would give users personal satisfaction, as they get to choose how they are displayed on their screen
2. Account Profile Picture: Profile pictures also gives users a sense of self expression, further satisfying users
3. App’s Backgrounds, Colours, and Music: The ability to change the app’s backgrounds, colours, and music would help make the app more inclusive. For example, some may be partially colorblind, meaning they can’t see certain colours. Being able to change the app with accessibility features tailored to the user’s needs would ensure they feel cared for. Some users may prefer a bland background, no colours, and no music, while others will prefer a vibrant background with upbeat music. It is based on personal preference and it is essential everyone is accounted for.

NFT Implementation

To diversify the market and increase user engagement and value, we plan to migrate everything to web3 platforms. This means that all user items will be stored in their own Metamask wallet. It will allow for the creation of a large marketplace where users can interact and bring value to their hard earned coins and pets. Additional features such as character customizations and even special items can all be handled easily through an NFT system that can securely and seamlessly store everyone's items and data on a decentralized network.

Increased Amount of Features

With further development of this project, we hope to increase the amount of features in the game, making it more interactive and engaging. We currently have a solo "free roam" cleanup mode, where users can go around their area cleaning garbage for in-game currency. However, adding more modes would help give users diverse choices on what to play, in turn maintaining and boosting the playerbase. Ideas we currently plan on implementing are:

1. More game modes: A variety of unique game modes appealing to different types of people.
    a. Online multiplayer tournaments where you put $WASTE up for stake and the person who cleans the most garbage wins everything over a 12-24 hour period.
    b. A story mode where users help fictional characters clean different areas near the user's location, while simultaneously learning about littering and how it negatively impacts the world. With AI generated stories based on the users location.
    c. A Wildlife rescue mode where users clean animals' habitats like oceans/shores, trails, and many more habitats.
2. Mini-leagues: Leagues/clans with friends where users can compete against each other and in league tournaments, where players accumulate points based on cleaned garbage over a 7 day period. The league with the most points wins xp and $WASTE.
3. Impact tracker: An impact tracker that counts tons of garbage cleaned daily, weekly, monthly, yearly, and total, proving the application's ability to address littering and providing motivation to users.

Limited-Time Modes & Rewards

To boost engagement and user-retention, we plan on implementing limited-time modes and rewards in the near future. Rewards that only last a couple of weeks would result in users extensively playing the game for a certain amount of time to complete quests and obtain the rewards only attainable for a certain amount of time. Limited-time modes would help add variety to the game, giving players choices on how they want to play, rather than playing the same game mode all by themself all the time. Various examples include:

1. Seasonal events: Events that reward players with pets commonly found in such season and weather, with also a certain xp boost when equipped during its associated season (For example an arctic fox that gives 1.5x xp year round and 1.75x xp during the winter).
2. Holiday themed cleanups: Cleanups where users can clean garbage during the festive season for holiday-themed rewards like character models, pets, etc.
3. Time-travel cleanup: Cleanups where users travel backwards or forwards in time to clean common times of garbage found in that era and will be rewarded with character models (knights, robots etc), emotes, and pets regarding that period of time.

Conclusion

Summary

GoGarbage addresses two major issues: excessive littering and increased antisocial behavior from screen overuse. Litter harms ecosystems, endangers wildlife, and threatens human health, while too much screen time reduces social interaction and attention span. GoGarbage tackles both by promoting eco-action through a gamified rewards system. At the core is $WASTE, the in-app currency users earn by cleaning up reported trash. The location-based app features a live map where users report and accept cleanup missions. AI image recognition verifies cleanup and compensates users with $WASTE, which can be spent or traded in-app. GoGarbage's tech stack is robust and innovative, using Supabase, Unity PlayerPrefs, and MetaMask for data storage and transactions. Built on Unity with C#, it integrates the OpenStreetMap API for mapping and a Flask API for backend support. The YoloV8 AI model ensures accurate garbage identification, and $WASTE currently operates on the Avalanche testnet, with plans to shift to the mainnet. Future updates include NFT pets and a virtual shop. The app's strengths lie in its real-time mapping, fair AI-driven reward system, and Web3-based economy. However, it may be less effective in remote areas with fewer users, and AI misidentifications and Web3's device compatibility limits are challenges. Planned updates like live weather integration will enhance the experience. GoGarbage's roadmap includes new content like Trashpass, multiplayer tournaments, and story gameplay. Seasonal events and NFT-based items will keep the platform engaging. To sustain growth, the app plans partnerships with green brands and groups, using sponsorships to fund development and maintain its mission of promoting global environmental responsibility.

Impact

GoGarbage has a high potential to reduce landfills and large amounts of trash waste from the planet. Players clean up and properly remove trash all while having fun doing it. Collaboration is also a key part in GoGarbage, and teamwork speeds up the endeavor to a cleaner planet. Not only is GoGarbage a positive initiative for the planet, but it gives rewards to the user as well. Players can earn $WASTE to redeem in GoGarbage, or to cash out as a bonus for money. GoGarbage is cleverly designed in a way where this can be implemented anywhere in the world, and is highly effective at the same time. Using clever methods like marker locations and trash proofing ensures the validity of a user's work. All in all, GoGarbage is the ultimate tool to help clean up our planet, at the forefront of modern technology. "Trash the Waste, Treasure the Planet"

Citations (APA Format)

National Geographic. (2024, December 15). Plastic pollution facts. Retrieved from https://www.nationalgeographic.com/environment/article/plastic-pollution

Ocean Conservancy. (2024, December 20). The truth about plastic pollution. Retrieved from https://oceanconservancy.org/trash-free-seas/plastics-in-the-ocean/

Niantic, Inc. (2025, January 5). How Pokémon GO encourages outdoor exploration. Retrieved from https://pokemongolive.com/

Rico, J. (2025, January 10). YOLOv8-based litter detection AI model. Retrieved from https://github.com/jeremy-rico

Sweatcoin Ltd. (2025, January 15). How Sweatcoin rewards physical activity with cryptocurrency. Retrieved from https://sweatco.in/

TeamSeas. (2025, January 20). Join the largest ocean cleanup in history. Retrieved from https://teamseas.org/

TeamTrees. (2025, January 25). Planting trees to fight climate change. Retrieved from https://teamtrees.org/

Thirdweb. (2025, February 1). Deploying Web3 applications and smart contracts. Retrieved from https://thirdweb.com/