

Deliverable D3.2

PTwist Platform Release



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Abstract

The present document provides an overview of the core PlasticTwist platform components (Blockchain network, PlasticWallet, PlasticToken, Marketplace, Gamification and Crowdsourcing) and their development stage by the end of the first year of project’s lifetime. The included video presentations of the current developed versions demonstrate their functionality and usage under the PTwist digital ecosystem.

Version Control

Version	Description	Name	Date
1.0	Initial draft	Mirko Koscina	22 October 2018
1.1	Blockchain component, chaincodes, API, and client apps	Pierre Cluchet	27 December 2018
2.0	Crowdsourcing toolkit, gamification module, conclusions	Vasileios Psomiadis, Georgios Vlahavas, Ilias Dimitriadis	30 December 2018

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1. Introduction

PTwist aims for a paradigm shift in plastics reuse practice via its engaging and sustainability framework that allows for experimentation with a novel plastics monetizing and incentivizing approach along with new social empowerment mechanisms, which will advance motivation and users engagement. By monetizing an everyday material (plastics) and twisting it to an asset which re-enters the market, PTwist progresses as a plastics circular economy mobilizing platform which will uptake disruptive technologies and generate both social and commercial impact.

To achieve these objectives PTwist offers cutting edge gamification, analytics, and circular economy mechanisms integrated under its open digital platform:

- 1) crowdsourcing tools to enable generation of an evolving plastic materials reuse taxonomy and an open plastic reuse machinery designs repository;
- 2) a monetary system of PlasticTokens cryptocurrency and PlasticWallets maintained by a blockchain based architecture which will safeguard trusted plastics reuse transactions among citizens and inventors;
- 3) citizens and communities rewarding and engagement experiences by interactive and collaborative gamification which embeds PlasticTokens crediting;
- 4) a virtual marketplace for exhibiting and commercializing of PTwist inspired plastics reuse products monetized in the proposed cryptocurrency.

The present deliverable, focuses on presenting a snapshot of the platform's current development status driven by the running tasks of WP3: *T3.2 - Core Modules Development, T3.3 - Pwallet Development, T3.4 - Platform Development, Integration, and Maintenance*; and WP4: *T4.1 - Tier-1 Gamification Tools*. But also presents content stemming from the completed WP2, which includes the fully developed crowdsourcing toolkit that continues to evolve and adapt in line with the project's overall progress.

In the next four sections the core components of the digital platform, namely crowdsourcing, gamification and monetization along with their various tools and applications are outlined and described briefly. Section 6 contains links to the presentation videos (due to their size they weren't embedded into the document) which demonstrate the current state of the developed software. The final Section 7 summarizes key findings regarding the current PlasticTwist platform release and the next steps from here.

2. Crowdsourcing Toolkit

The PlasticTwist platform includes a crowdsourcing web application, which consists of three main parts:

- A. An observatory of crowdsourced plastic topics
- B. An open designs repository
- C. An open Crowdsourcing API

The plastic observatory is a stand-alone, but vital part, of the PTwist platform. It is responsible for the identification and detection of simple and sophisticated content about the plastic reuse thematic, correlations, trends and phenomena. It is based upon the intelligence that has been extracted using available Social Media sources. However, very few of the popular sources allow users – developers to have access on data, even if these are public posts. Therefore, the crowdsourcing tool will offer information and knowledge that has been collected by analysing data from **Twitter** and **Flickr** (due to some recent advances regarding available data sources, in the future the tool may include data from **Instagram** as well).

To achieve this, a module that collects and analyses data from Twitter in real-time has been developed. More detailed design specifications of this module are described in deliverables D2.1, D2.2 and D3.1. The module has been built using advanced social media collection and analytic techniques in order to extract the wisdom of the crowd as captured in social media. The key contributions of the plastic observatory can be summarised in the following list:

1. offers advanced, yet easy to understand, visualisations of the wisdom of the crowd;
2. allows the platform users to understand plastic thematic relationships;
3. raises awareness regarding plastic pollution;
4. identifies “key players” regarding the plastic reuse – pollution;
5. improves the plastic reuse lifestyle perception in general by providing relevant and interesting content;
6. provides information regarding plastic focused in specific locations and time periods.

In respect to these, the crowdsourcing web app features the following:

Geographical Information regarding plastic (Locations): We use Twitter to fetch posts that have to do with the plastic thematic (pollution, reuse, innovation, etc.). The platform user can navigate through a map that presents an overview of the Twitter activity per location. More specifically, the map presents numerical figures that depict the number of the tweets posted from each area. By moving the cursor over the numbers, the user can see the borders that define each area and can use the cursor scrolling to zoom in or out of the map and the date range picker to visualise the statistics of that period. The user can select certain plastic thematics (input by pilots) and a specific language. There is a heatmap option which provides a different visualisation of the tweeting activity of each area. Finally, the user can also select a certain area by using the "ENABLE MAP SELECTION", proceed with the selection and get information about the most common words and hashtags that have been used among the tweets that have been posted from these locations.

Wordclouds: The wordcloud is a useful visualisation of the most frequent words or hashtags. The larger the font size, the most frequent the word - hashtag. This tool can help the user identify new trends, possible connection with other topics and new emerging topics. This section also offers date, thematic and language filters (as presented in the Locations section).

Top Tweets: This section displays the tweets that had the greater impact on Twitter users. The user can use the filters provided, to get more specific results (Date - Topic - Language). The tweets that are presented are the ones that have been Retweeted more times than the others or have been marked as Favourites by more users. All the results are clickable, allowing user interactions (leave comments, retweet, mark as favourite, etc.), thus enforcing the users to share and disseminate topics, news, events that they find interesting.

Top URLs: Similarly, to the previous section, this one displays the URLs that had the greater impact on Twitter users. The user can use the filters provided, to get more specific results (Date - Topic - Language). The URLs that are presented are the ones that have been used more times in the posted tweets.

Influencers: A social media influencer is a user who has established credibility in a certain topic. Influencers usually have access to a large audience and can persuade others by virtue of their authenticity and reach.

Taking advantage of the connections between Twitter users, a network of users that are involved with plastic in general is created. Using the appropriate algorithms, the tool is able to identify these users that seem to have a greater influence on others and present a list of the top 100. Therefore, the platform user can connect to these accounts and stay up-to-date with advances regarding plastic reuse, pollution, recycle, etc.

Another important part of the crowdsourcing toolkit is the open designs repository. This repository features 3D printer designs, using the **Thingiverse** open API and images hosted on Flickr that contain the identified top hashtags, using the **Flickr** API. The user can visit the interlinked repository and browse through Popular, Featured and New designs as classified by Thingiverse. Another section that contains 3D printer designs made by PTwisters and hosted in the *PlasticTwist Thingiverse Group* has also been integrated. There is also a list of external sources that contains information about interesting plastic designs and machines that gets updated periodically.

Finally, the crowdsourcing kit also includes an open RESTful API which allows the platform users to have access on the data that are presented in the web app and are produced by the social media analysis phase. The API offers the possibility to all users experiment with the collected data, use them for research and evaluation purposes. One of the most important features of the crowdsourcing toolkit is that it covers the temporal evolution of the plastic related data, allowing the user to focus on a specific period and on a specific thematic.

3. Dashboard and Gamification Modules

The gamification component of the PTwist platform consists of two tiers. Tier-1 covers gamification tools accessible at the applications layer over web and mobile interfaces. Tier-2 includes global gamification elements that are implemented on top of the platform. More over, under this component falls the whole user experience which includes the front-end dashboard interface that provides the interaction framework between users and the platform's tools and services.

For tier-1 gamification a complete game experience has been developed: a mobile game named 'Plastic Heroes'. In this game, the players are activists that want to protect the environment by collecting and reusing plastic waste and to enlighten themselves and other people with information about the topic. It is designed as a serious game with focus both, on e-learning elements and a fun gameplay that aims at behavioural change. Moreover, it incorporates a rewarding system connected with the monetization component of PTwist in order to incentivize players and increase their overall engagement with the PTwist ecosystem. A detailed description of the developed tier-1 gamification tools can be found on deliverable *D4.1 - PTwist Tier-1 gamification toolkit*.

The dashboard, part of tier-2 gamification, is the main entry to the PTwist's online platform. It includes a unified user registration and login system that allows users to authenticate and access PTwist's features. A navigation menu provides quick and easy links to all functions and services supported by the PTwist platform. Users can manage their account and also have a peek at their game progress and statistics along with their PlasticWallet's balance. The dashboard is developed using the Bootstrap front-end framework, HTML, CSS with the less preprocessor and jquery (JavaScript library). While in the current version the custom-build UI is complete, the integration with the other platform modules via their respective APIs is still ongoing.

4. PlasticToken & Marketplace Modules

The released blockchain software consist of three separates entities:

- ERC20 chaincode
- Invoicing chaincode
- Marketplace chaincode

These three entities run on top of hyperledger fabric blockchain. They each provides functionalities to read and write, with access and rights control, into the distributed ledger.

The ERC20 chaincode is the software handling the PlasticTokens in a secure manner. These tokens are up to the ERC20 standard, meaning a fixed amount of tokens will be minted when the chaincode is deployed. This amount is called "*TotalSupply*", and will be assigned to a special user, called "*centralbank*" in the current implementation.

Once the original PlasticToken supply is minted, users can interact with it via a "transfer" functionality. It allows the central bank to send tokens to any previously enrolled user, then each user can use this same function to transfer tokens between each other.

To meet the ERC20 standard, users can also allow each other to withdraw their tokens on their behalf, to do so, they can use "*approve*" and "*transferFrom*" functionalities. A complete guide on how to trigger these functionalities is available on the project's source code repository available at Github:

https://github.com/pcluchet/ERC20_fullstack

The invoicing chaincode allows users to record invoices in the blockchain. These invoices contain information such as names and prices about their items, and are assigned to a particular user, allowing for later audit and control. Moreover, this decentralised invoicing software allows users to pay directly in tokens using a "payBill" functionality, this action will trigger a call to the ERC20 software, and transfer the total amount of the bill to its emitter, once again recording who paid in the ledger.

Finally, the marketplace chaincode allows users to buy and sell items between each other. To do so, it allows them to administrate a virtual shop, linked to their identity in the blockchain. In each shop they can create items, provide some information about them such as their quantity and a description, and sell them for either a fixed price or at auction.

Other users can then buy these items at a fixed price or compete between each other by bidding. Once the sell is complete, the marketplace software is also able trigger a PlasticToken transaction to transfer the final price automatically.

5. API & Blockchain Client Apps

To use the software described in Section 4, the client apps are provided an API that greatly simplifies their interactions with the blockchain software. This API handles the credential management (registration, authentication) and allows clients to trigger chaincode functionalities.

Regarding the credential management, the final users of the API are only given their public key, constituting their address in the blockchain. The private keys used to sign the blockchain transactions are handled by the API. It allows users to use them via a login/password authentication. Moreover, the API also allows the clients apps to use *sessionid* tokens to authenticate, allowing the clients not to store the user credentials at any point, increasing the system general safety. Nonetheless, the next version of the API will feature a new credential management system, using the newly released “wallet” functionality of hyperledger fabric, and will be secured by HSM, to ensure maximal security.

The API allows the users to access the chaincode functionalities in two ways: by querying, or by invoking. The query operations are read-only and can only be used to retrieve data already in the blockchain. It allows the transaction to be fast and very modular, since no data is written and any information can be retrieved from the ledger. The invoking functionality of the API is the one allowing users to write into the ledger, by calling a writing function in the chaincode. This kind of transaction is slower because the blockchain nodes need to validate the outcome of the said transaction, and agree between each other.

This API is used by two prototype client apps for now, one in the form of a mobile application, that acts as a wallet for the PlasticTokens and allows users to create invoices; and another in the form of a website, aiming to provide an “ebay-like” experience using the marketplace chaincode.

The mobile app allows the users to log-in using their login/password credentials. It displays their PlasticToken balance, and a small history of their token transaction. Users can add other users addresses in a contact list, via a QR-Code system, and transfer token to them.

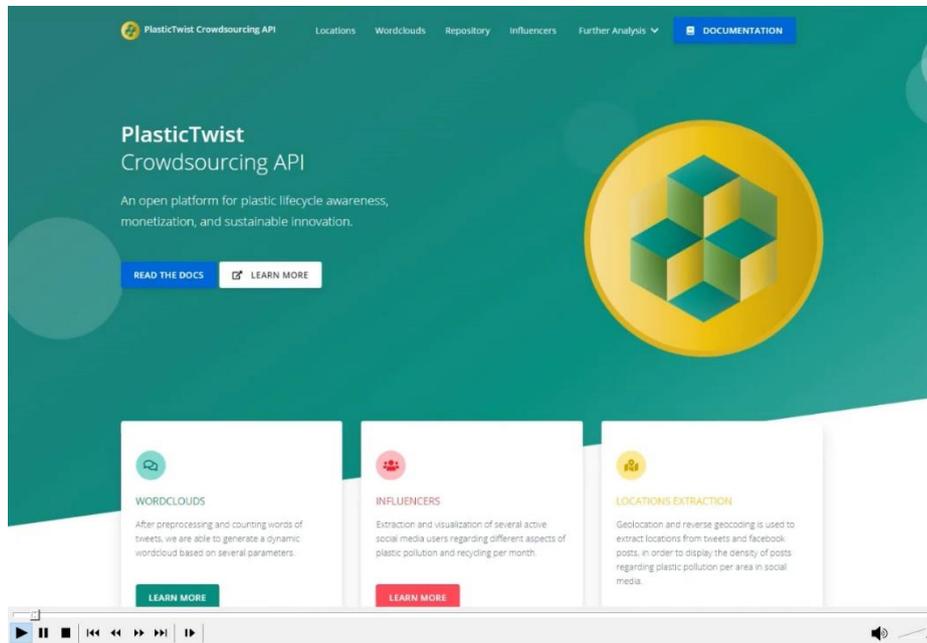
Additionally, they can also generate a bill, that will be linked to their account address, then other users can pay it via a QR-Code based system.

The online marketplace consists of a regular online shopping website, except that every user can post items. The users can search among the available items and buy them, triggering an automatic token exchange. They can then see the token transfer on their wallet app. The PTwist marketplace also allows users to bid on items, sold at auction, and pay for them in the same way when the auction is over. It also features an administration page where users can manage which items they are currently selling, and see a list of what they have already sold.

6. Video Presentations

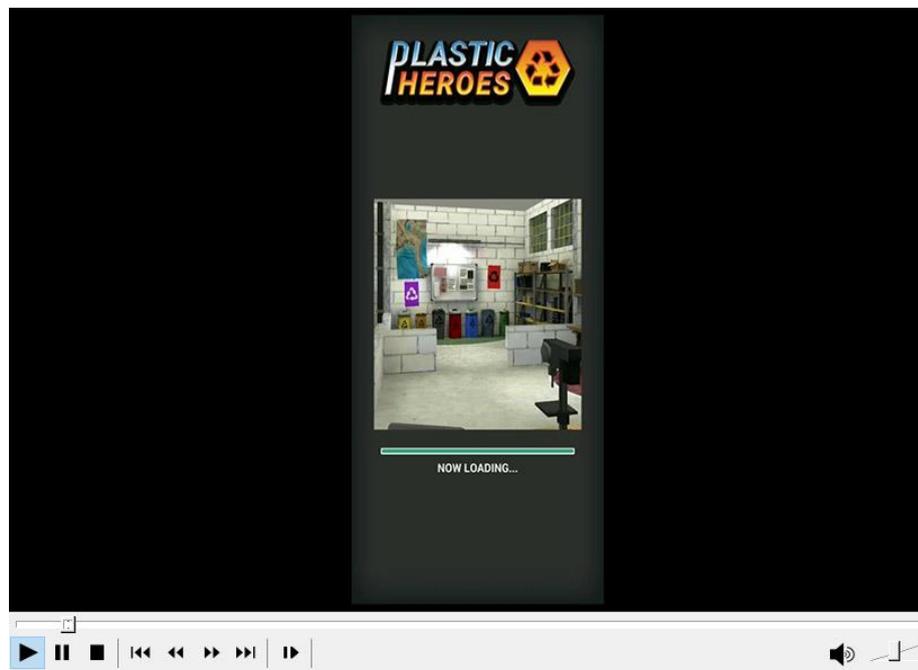
To better demonstrate the current versions of the various modules that are part of the first PTwist platform release the following presentations were produced:

a) Crowdsourcing Toolkit



Visit the following URL to watch the video: https://ptwist.eu/videos/video_3_2.mp4

b) Gamification Tier-1 mobile game

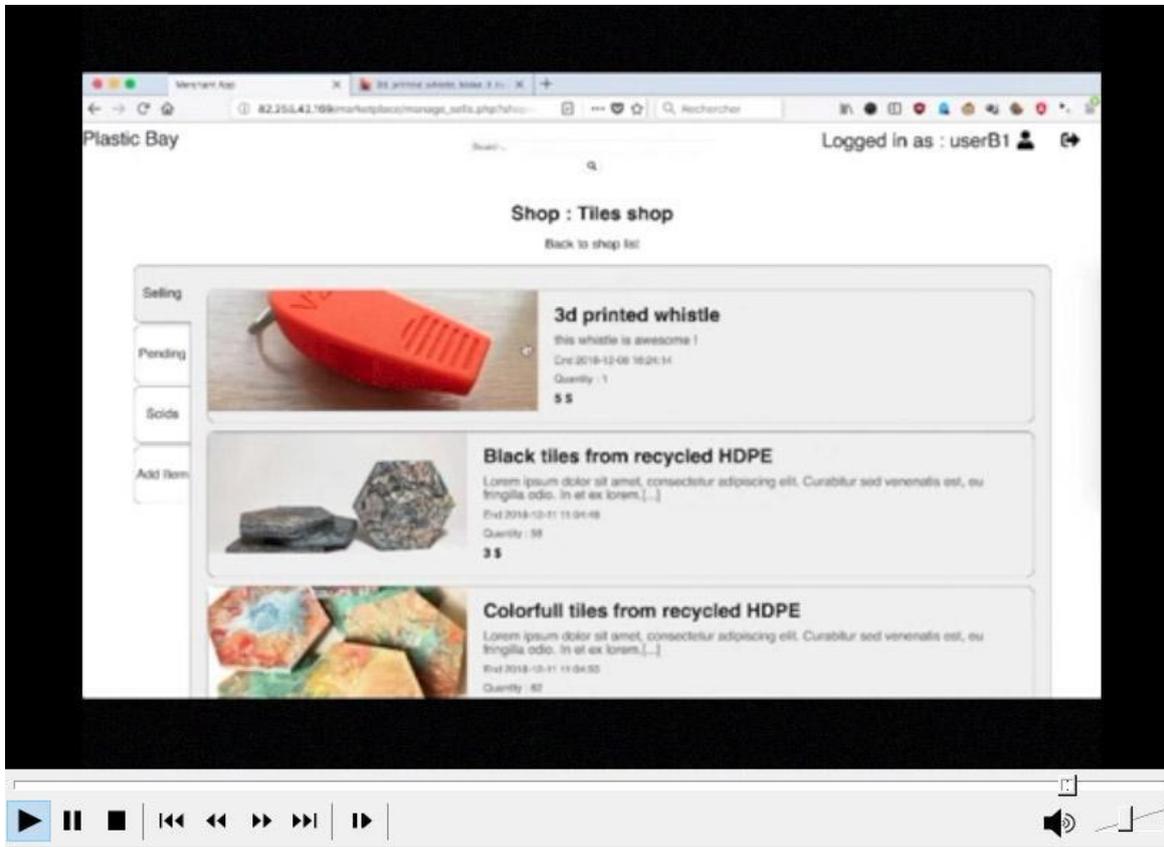


Visit the following URL to watch the video: <https://www.youtube.com/watch?v=I8-VFZjDzSs>

c) The latest dashboard prototype is available for live demonstration on the following URL:

<https://ptwist.eu/dashboard/>

d) Blockchain component / PlasticToken / PlasticWallet / Marketplace and Client Apps



Visit the following URL to watch the video:

<https://drive.google.com/file/d/1AnqRCbw6AvGbX2MbuOidlZZ-Y7DniUiZ/view>

7. Conclusions and next steps

The current document provided a synopsis on the latest developments of the PlasticTwist platform's components at December 2018 (M12 of the project's timespan). Focus was given to demonstrate the functionality offered by the platform's components at the current development stage, through the supplied video presentations.

The first release of the PTwist platform finds each module at different level of maturity, which is expected under the project's implementation plan that not only foresees various development stages throughout the project's lifetime but also dictates a flexible model in which technology partners develop, test and integrate software in iterations.

- As demonstrated, for the data analytics component based on crowdsourcing, which was run under relevant tasks of WP2 that was finalized by M10, development is complete and it is ready for public deployment. Though the main development phase is concluded, AUTH's team responsible for its development, is continuously evolving and improving it.
- For gamification, Tier-1 gamification tools, in the form of a mobile game, have been developed and have reached a functional prototype stage based on the use cases and initial requirements. Tier-2 gamification, which provides the web-based framework utilized by the users to interact with the online platform and the rewarding mechanism, has been through the design and implementation phase and currently is in the system integration process.
- Regarding the monetization module, a crucial component of the platform, the back-end implementation based on Hyperledger Fabric along with an API that enables interaction with the PTwist Blockchain have been completed. Furthermore, there are fully working prototypes of the PlasticWallet and Marketplace client apps that currently undergo the second cycle of development after receiving internal feedback from the consortium's partners.

Following the chosen agile methodology, the various technologies and software modules are being actively developed and advancing under a continuous evolution and improvement cycle. At the moment, all of platform's sub-modules are undergoing a thorough system integration process aiming for the upcoming activities of the project's three pilots in the second quarter of 2019, where the PTwist's digital services will be put to real-life use and tested by a public audience.