

Implementation of Liter of Light on Blockchain

January 22-24, 2018



LITER OF LIGHT & ANTENNA FOUNDATION
@ FUTUREHACK KLOSTERS

1 Team

1.1 Liter of Light

Liter of Light is a three-year-old open source movement enabling women cooperatives to generate money for their communities by starting their own solar light manufacturing and repair business-making it the only sustainable solar light initiative of its kind.

Liter of light is providing material in form of micro loans in 30 countries. So far, Liter of Light has enabled the deployment of over 1 million lights.

1.2 Antenna Foundation

Antenna Foundation is a swiss non-profit foundation that engages in research and the dissemination of technologies to meet the basic needs of populations at the bottom of the pyramid. Antenna is currently involved more than 60 projects in over 20 countries regarding nutrition, drinking water, medicines, energy and new technologies to meet basic needs.

1.3 Team members

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2 Business Case

Liter of Light is a fast-growing global organization. This success has also brought about unique challenges. To maintain sustainable and scalable growth, the organization needs to overcome the following hurdles:

- Difficulties attracting individual donors
- No automated fraud prevention
- High cost of money transfer internationally
- Audit challenges due to global presence

- Organizational growing pains - decision bottle neck
- Vulnerability of women coop members because of cash transactions in the field

In a recent strategy paper, Liter of Light has developed the following vision:

Changing the face of charity by

1. ***building a robust and efficient marketing engine by***
creating an immersive donor experience to ensure rapid growth of private supporters by creating an end-to-end accountability & transparency of how, where and when donations are used and how donations impact the lives of communities.
2. ***by creating frictionless auditability, trust and transparency to***
attract more institutional donors through transparency and greatly reducing their due diligence costs and by creating monetary performance guarantees.
3. ***by creating real-time visibility to***
optimize its global operations by visualizing all process flows.

3 Description of existing process

Liter of Light receives donations either in the country in which the solar lights are deployed (e.g. Brazil) or in a foreign country (e.g. Italy). The receiving entity then makes purchasing decisions and sends the required funds to an external supplier in the region the solar lights will be deployed (this often requires international money transfers). To reduce overhead and cost, Liter of Light does not want to order and ship materials from a central location. Once the supplier has the material ready, it is shipped to a Liter of Light warehouse.

There, approved women organizations (coop's) can pick up materials in Liter of Light warehouses and then assemble and sell/rent the products in their communities. In addition to selling/renting them, the women also repair and maintain the products.

Once the women organizations receive payment from their customers they go back to the warehouse and repay the micro loan. So far Liter of Light has a 98% repayment rate.

4 The Hackathon Project

The initial project architecture aimed to solve all inefficiencies of the existing operating process. However, it quickly became apparent the hackathon team had to limit their

focus to a specific area within the organization to reduce complexity and therefore make it attainable to solve within the 48 hour window.

The main element of complexity are the numerous interactions between internal and external entities in the least developed regions of our planet. In addition, the diversion of established processes are frequent and unpredictable.

Furthermore, the team did not have access to any developers/coders and UI/UIX designers and had to learn most of the required skills to complete the Hackathon tasks on the fly. However, it is important to note that the simplified project has been designed as a pilot to enable future improvements to be built directly atop of it, therefore making it a scalable blockchain project.

4.1 Project Design

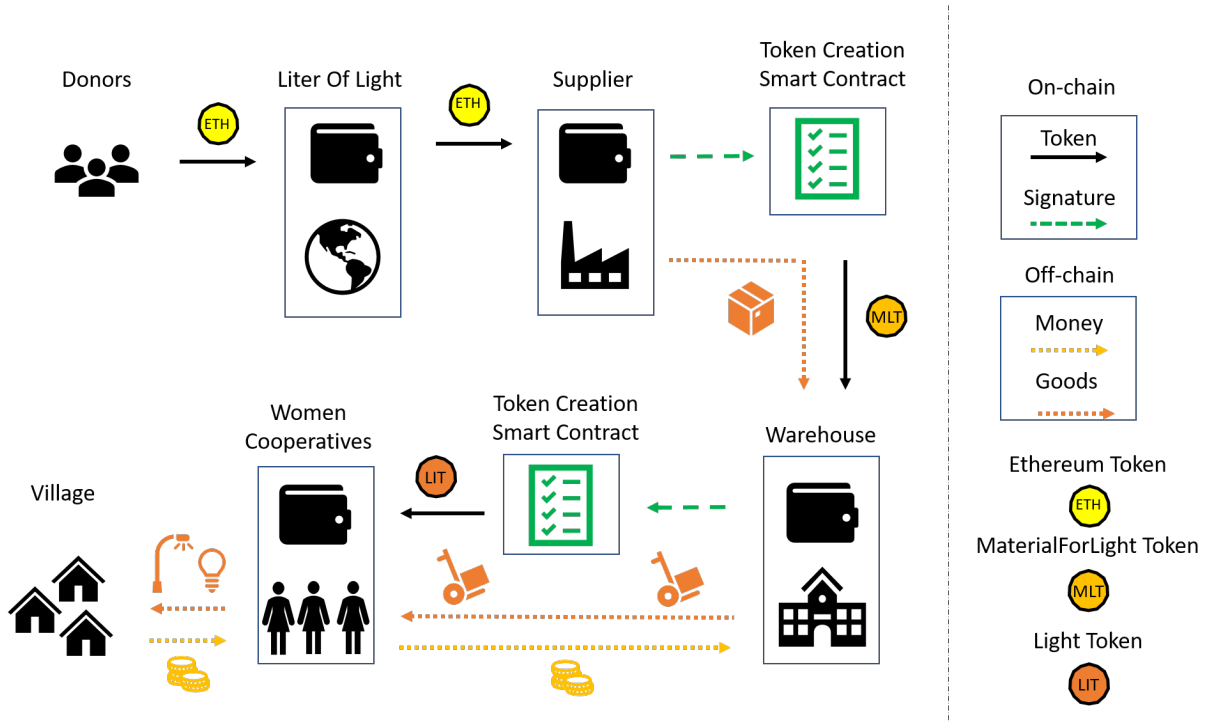


Figure 1: Interaction illustration of the hackathon project. Refer to the legend to compare the duality between the real world and the tokenization on the virtual network.

4.2 Description of digitized process

For the Hackathon the digitalization process assumes receiving donations in ethers. The ethers are sent from the receiving entity to the selected supplier. This transaction represents the payment for the production and delivery of materials. Once the material is ready, the supplier ships the material to a Liter of Light warehouse and triggers minting the amount of tokens corresponding to the number of units shipped. The respective

warehouse then receives the material and the corresponding amount of tokens (the *MaterialForLightToken*). When an approved representative of a women cooperative picks up material at the warehouse, the warehouse triggers the minting of a new token called *LightToken* deployed directly on the wallet of the representative - representing the amount of units picked-up. The flux of the two ERC20 compatible tokens enable a traceability of the inputs/outputs of the materials distributed.

In a whole, the payments as well as the materials are tracked giving transparency (allowing accounting audits) at every level of the process. In other words, the donors can see the impact of their donation, seeing when and how many units where distributed to women cooperatives.

4.3 Project Design Notes

The process between the warehouse and the women cooperatives is mirroring that between the supplier and the warehouse. This process replication is due to several Ropsten Test Net trials, which revealed the inability to send tokens from one address to another (trial focused on MyEtherWallet and MetaMask).

Therefore, our workaround was to mint tokens directly to the next entity down the flux. Thus, entering the wallet address of the corresponding entity in the `address` to of the `mint` function.

4.4 User Interface

Almost every actor involved in this process requires a specific user interface. The donor will be using a user interface enabling him/her to enter the donation code and track the distribution of lamps. The manager of the Liter of Light entity will be using (besides its wallet) an interface to visualize the allocation of its funds and the flux of materials. The supplier will be having a wallet and a user interface to decide the amount of *MaterialForLightTokens* to be issued (which triggers in the back-end the minting of these tokens through the smart contract). The warehouse will be using a similar user interface coupled with visualizations to track their material distribution.

The user interface for women cooperatives will show the amount of tokens they have received - which represents the corresponding amount of material they have received.

4.5 Code

The codes of our two tokens are available on Github under <https://github.com/Literoflight/LiterOfLight-FutureHack>. They consist in two Mintable ERC20 Tokens given open source by the OpenZeppelin framework (<https://openzeppelin.org>). The base codes are taken from: <https://github.com/OpenZeppelin/zeppelin-solidity/tree/master/contracts/token/ERC20>

4.6 Demonstration of the interaction on Ropsten Test Net

This section aims to present a short screen-shot demo of the Hackathon Project key interactions.

The first screenshot illustrates the mint of the *MaterialForLightToken* by the supplier's wallet directly in the wallet of the Warehouse.

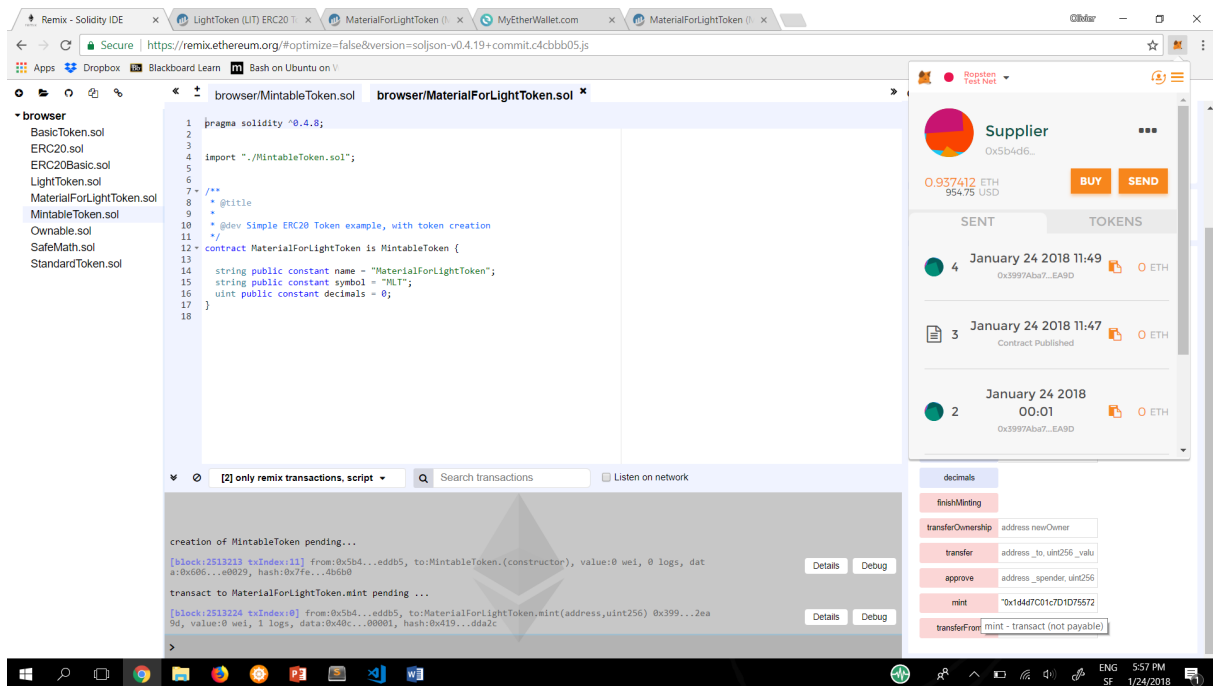


Figure 2: Mint of *MaterialForLightToken*.

The second screenshot illustrates the balance of the warehouse holding the *Material-ForLightTokens*.

The screenshot displays the Etherscan.io interface for the ROPSTEN (Revival) TESTNET. The main content area shows the token details for MaterialForLightToken (ERC20-TOKEN). The token holder's address is 0x1d4d7c01c7d1d75572440e72b2013366ec17d43a. The token balance is 51 MLT, with a value of \$0.00 (100.0000%). The token decimals are 0. The contract address is 0x3997aba78fd2ce156a88a01aee3bed60b72ea9d. The page also shows a table for token transfers, which is currently empty, indicating no transfers have been found.

Token Holder:	0x1d4d7c01c7d1d75572440e72b2013366ec17d43a
Value per Token:	\$0.00
Token Balance:	51 MLT
Token Value:	\$0.00 (100.0000%)
No. Of Transfers:	0

Contract Address:	0x3997aba78fd2ce156a88a01aee3bed60b72ea9d
Token Decimals:	0
Official Links:	Not Available, Update ?
Search/Filter By:	[Reset Filter]

TxHash	Age	From	To	Quantity
There are no matching entries				

Figure 3: Balance of the warehouse.

The third screenshot illustrates the mint of the Light Token by the warehouse's wallet directly in the wallet of the Women Cooperative.

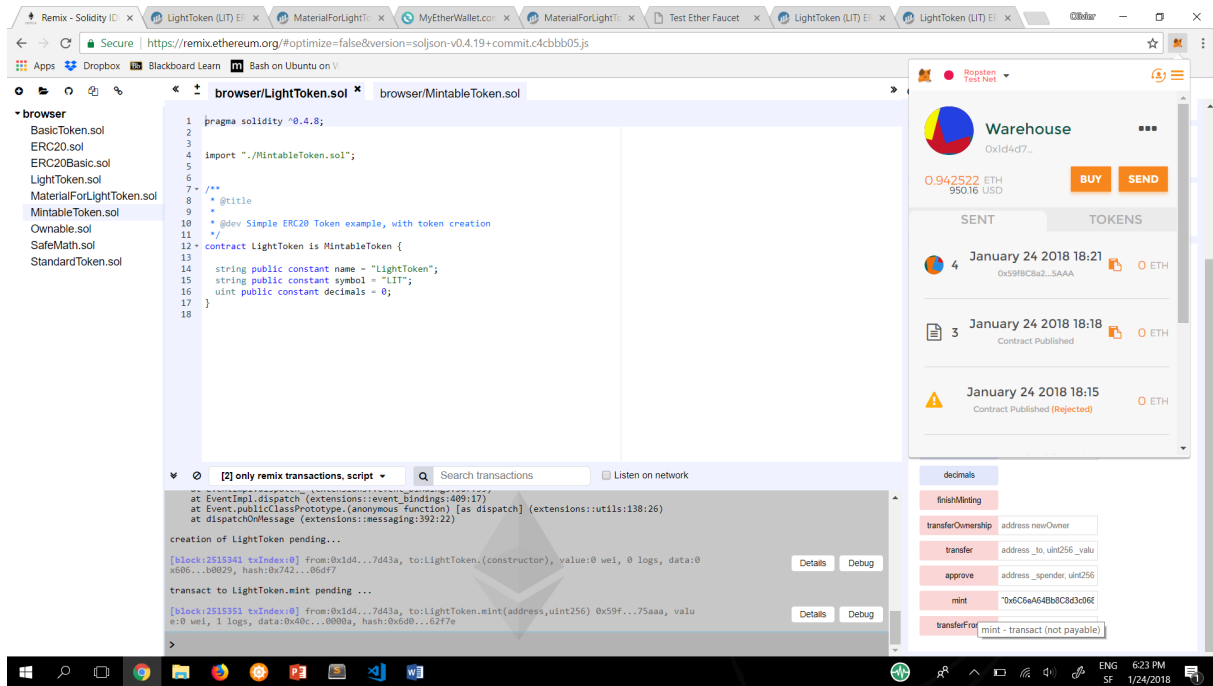


Figure 4: Mint of the Light Token.

The fourth screenshot illustrates the wallet of the Women Cooperative that received the Light Token.

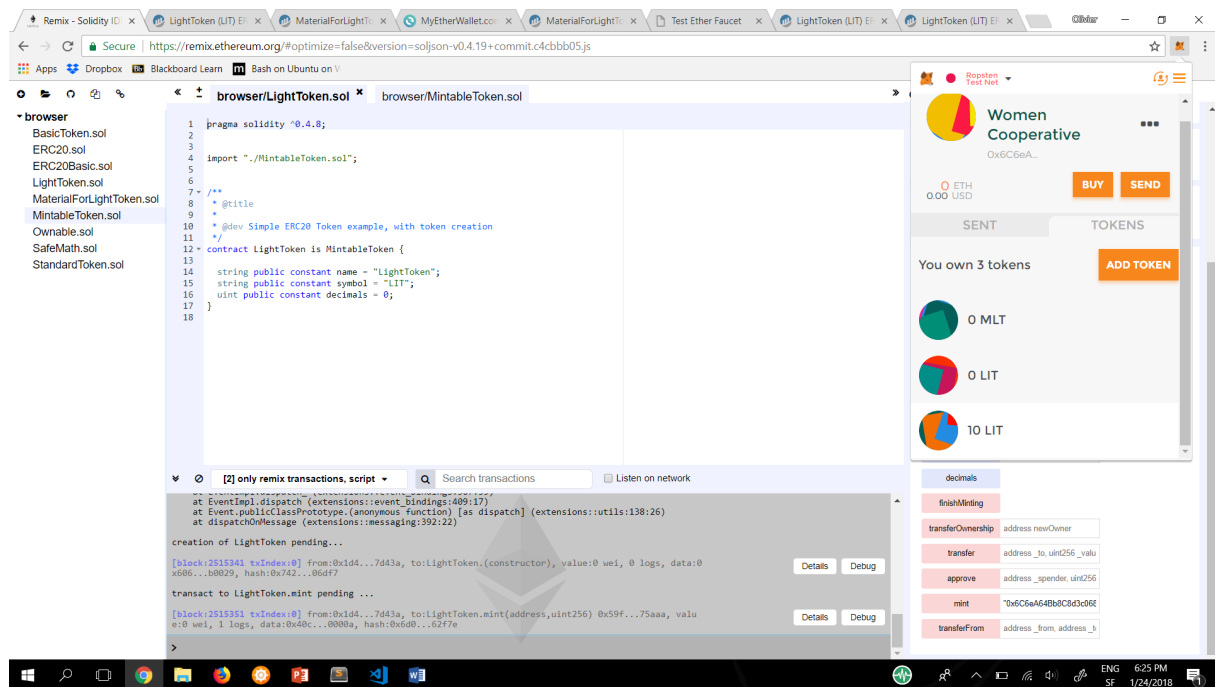


Figure 5: Wallet of the women cooperative.

The fifth screenshot illustrates the balance of the Women Cooperative that received the Light Token. This can be used to track the impact of the donation.

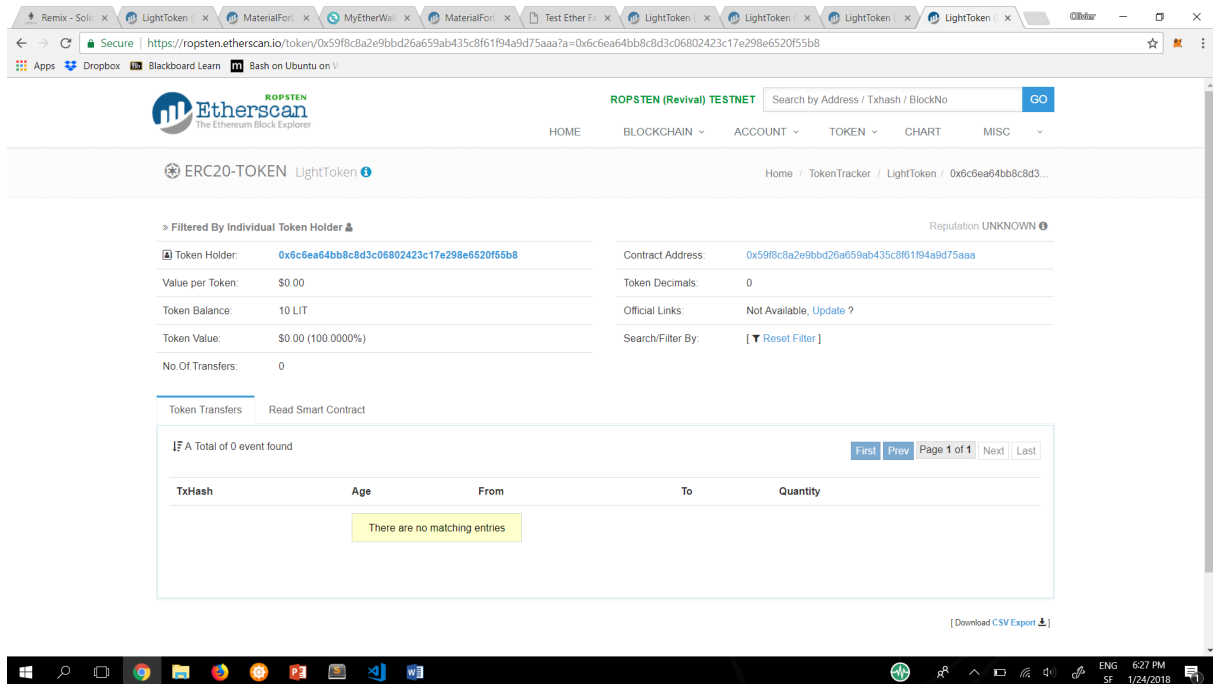


Figure 6: Balance of the women cooperative.

5 The Blockchain Liter of Light Pilot Project

As mentioned earlier, due to the lack of coders in our team, the project had to be simplified.

This chart is intended to show you the process we originally intended to code. The major improvement resides in a multi-signature escrow token mintable smart contract.

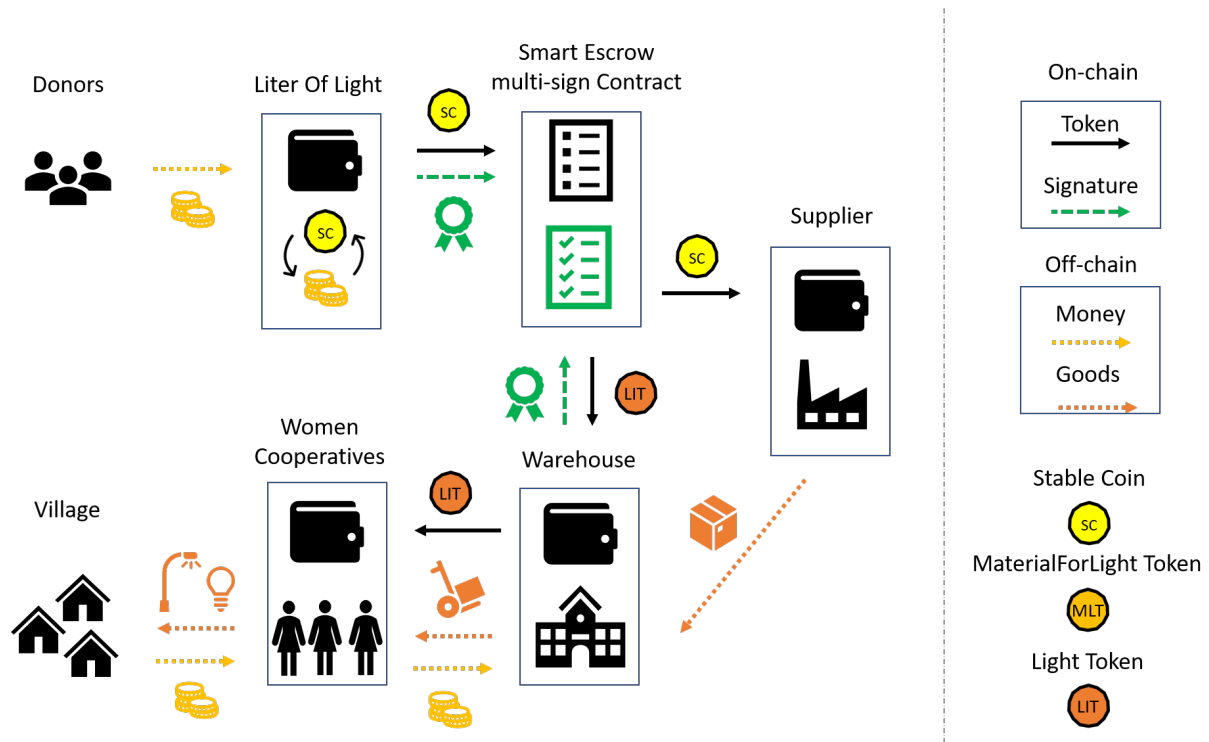


Figure 7: Interaction illustration of the pilot project; Please refer to the legend to compare the duality between the real world and the tokenization on the virtual network.

In order to be as concise as possible, the additional features illustrated above are explained in bullet points below.

The project contains the following features:

- The cash donations are directly transformed into a virtual coin that has the following characteristics:
 - The coin is pegged to a real value that is stable and commonly recognized (“stablecoin”)
 - The coin is tradable against the real value in selected entry points (cashing-in coins)
 - The coin can be issued by a third-party guarantor for its value (e.g. Everex)
- The payment to the supplier is enforced by an escrow smart contract with a signature requirement. This smart contract has the following key functions:
 - Execution of the contract is triggered by the digital signature of the warehouse.
 - In case of dispute between the two actors; a Liter of Light manager can intervene and unlock the funds.
 - At the execution, the payment is sent to the supplier.

- At the time of execution, the contract issues the number of tokens corresponding to the material/number of lights that should be delivered by the supplier (the *LightToken*).
- The communication between actors are made off-chain to lower on-chain costs (gas consumption).

6 Takeaways

Were we able to lay the foundation to support the future vision of; first building of a robust and efficient marketing engine, second creating frictionless auditability, trust and transparency, and third achieving real-time visibility through tokenization. Every deployed solar light can be tracked by village and represented by a specific *LightToken* (or the according to amount of tokens corresponding to each product). During the Hackathon we not only discovered the power of blockchain but also the limits of the currently deployed blockchain technology and its related tools. For example, we intended to transfer our *LightToken* ERC20 compatible from one address to another using online wallets, which did not work with the tools accessible to us.