

smartTAP Operational description

Water dispensing system for public water points

Introduction

This document provides supplementary information about the LORENTZ smartTAP solution. The solution is designed to be part of a sustainable water system. The key uses for the solution are:

- To provide accountability for water and reduce waste
- To provide equitable use of water
- Provide mechanisms for revenue collection where shared infrastructure is used.

This could be simplified as a "pay at tap" or "pay as you consume" model. smartTAP applications are much wider than revenue collection. smartTAP uses the latest technology which means the system is very flexible and can be customized to fit any social, business or resource constrained situation.

Roles and terms described in this document

Water Operator: The company, organization, or entity that owns the water revenue stream. The Water Operator is ultimately responsible for revenue.

Water Seller: A local agent who is responsible for selling water credits to Customers. Water Sellers can often take on additional tasks such as registering new Customers in the system and housekeeping tasks around the Water Dispensers.

Customer: The water consumer who is using the Water Dispenser.

Tag: The secure NFC (near field communication) tokens that are issued to each Customer. The tag is like a wallet that holds available water credits and some basic Customer data for identification purposes.

Water Dispenser: The device that provides water to the users. The dispenser replaces an existing traditional tap. As the dispenser is solar powered, it needs only a water connection and has a battery inside for use 24 hours per day.

LORENTZ smartTAP app: An Android based smartphone app that is used by the Water Seller. The app uses the secure NFC capabilities of modern mid-range smartphones to read and write data to the tags.

Water Sellers are registered to use the App and are identified by login.

Entitlement: A special separate wallet held on that tag. A user's entitlement is how many free water credits they receive per day. Entitlement credits reset and renew every 24 hours. Entitlement allows for the system to be used for equitable water distribution or as a mechanism to protect vulnerable members of society.

partnerNET: Web based portal for registered LORENTZ partners and Customers to access information.

LORENTZ Global: Cloud based management system for monitoring and management of LORENTZ products including solar water pumps and Water Dispensers. LORENTZ Global manages technical and operational aspects (use) of systems in the field.

LORENTZ partner: An organization that is approved and trained to sell, install and service LORENTZ products.

LORENTZ smartTAP operating principles

Credits and currency: The system operates on water credits. 1 water credit = 1 litre. Credits are added to the Customer's tag based on the price that is set by the Water Operator. This fixed "exchange rate" encourages users to add credits in advance. Seasonal or time of day tariff changes manipulate the number of litres dispensed per credit.

Prices per credit are advertised throughout the scheme.

Dispensing resolution: Water is dispensed in 100ml (0.1 litre) increments. The exact amount of credit is held on the tag. This resolution allows for a cup to be dispensed or a large bucket to be filled accurately.

Operation

Dispensing: A Customer holds their tag close to the target on the front of the dispenser. First the amount of credit is shown and then after 1 second dispensing starts. Dispensing continues until the tag is removed. These actions are intuitive and instantly accepted by the Customer.

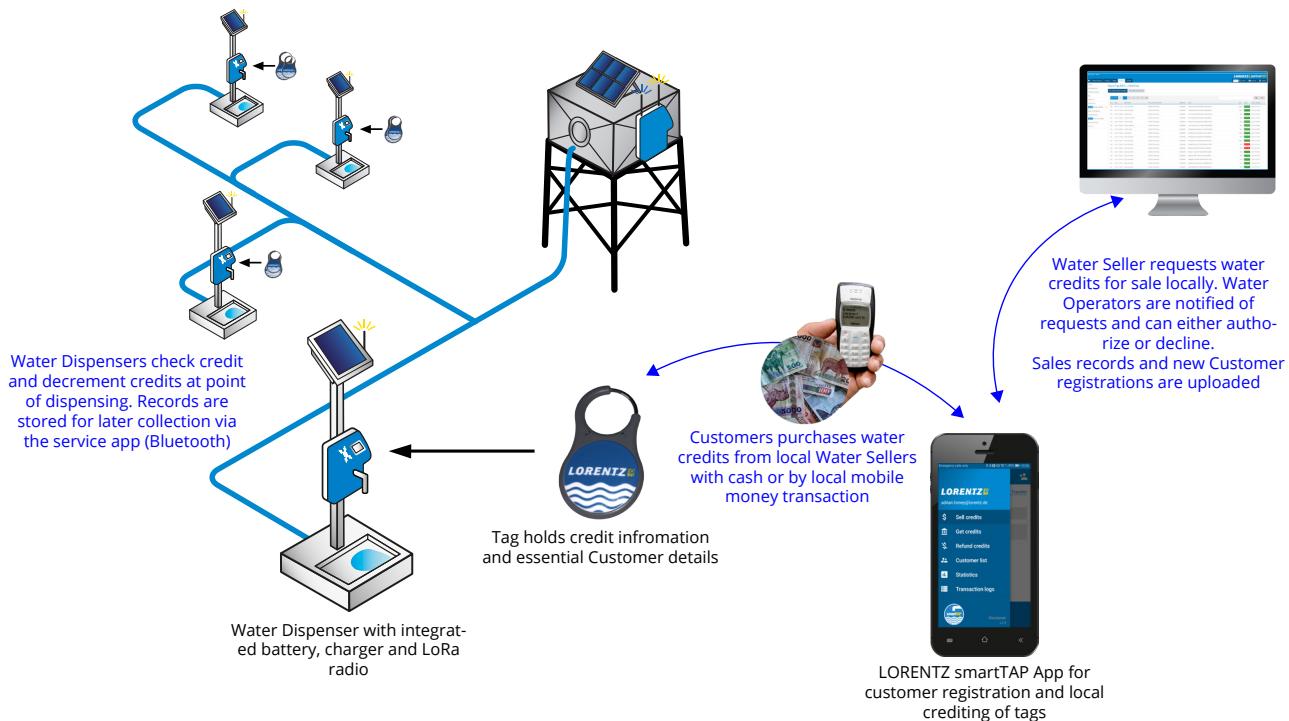
Dispenser interaction: The dispenser has an LCD screen which explains the use of the dispenser and provides information about water credits available and the status of the dispenser. All communication is with numbers and symbols and is suitable for low / no literacy users and is accessible for people with limited vision or dexterity.

Adding credit: Credit is added to tags either by visiting a Water Seller or by buying credits online and visiting the dispenser.

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Offline working

Introduction

The offline working model allows a sustainable water dispensing network to be implemented simply and quickly.

Offline working requires only 3 components.

- A Water Dispenser
- Tags
- A Water Seller with the LORENTZ smartTAP App

Setup and configuration

Water Dispensers are installed where required. Installation only requires a water connection. The Water Dispenser is supplied with a small PV module and cables.

The Water Dispensers are registered by an approved LORENTZ partner who will install the configuration on the dispensers using an engineering application. The process is fast and secures the dispensers to the Water Operator. Unique security

keys are deployed across the Water Operators network ensuring that tags, dispensers and Water Sellers are all in the same pricing structure. This means that only credits that are sold on the network can be used on dispensers on the network.

Water Seller accounts and Water Operator accounts are configured.

Customer introduction

Tags are issued to Customers within the community. Each household or Customer has a tag and their details are registered using the smartTAP app. This can be done offline. Tag issuing is normally done in one of two ways:

- Tags are purchased and a credit added (like a pre-paid SIM card) where revenue collection is the priority.
- Tags are given to Customers where equitable access to water is the priority.

Water Seller credit handling

Water Sellers request more credits using their app. Credit requests are received by the Water Operator (email alerts). The Water Operator checks payment (cash or mobile money) and accepts or rejects the request. Credits are passed to the Water Seller automatically. The Water Seller needs an internet connection to collect their credits, but does not to sell them, daily operation is offline.

Customer adding credits

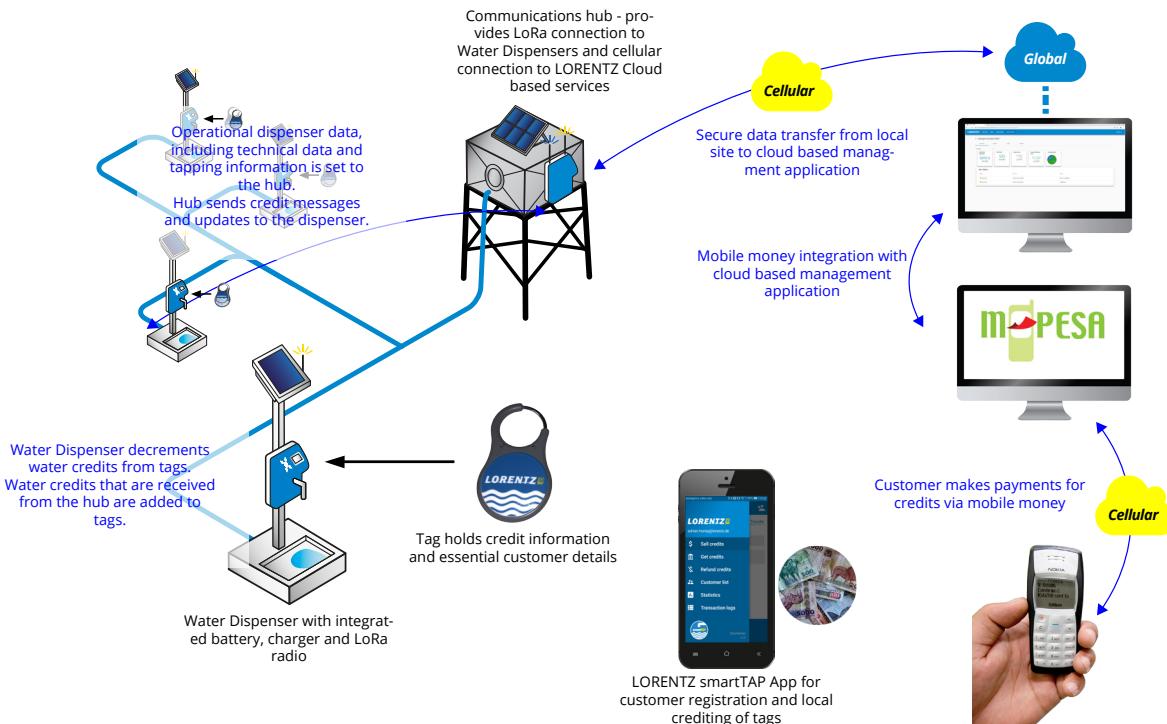
The Customer first visits a Water Seller, presents their tag and appropriate payment. Following this, the Water Seller's smartphone app assigns the credits instantly to the tag.

System data

Each dispenser records all transactions and technical data. Each Water Seller app records transactions. All transactions can be uploaded to the LORENTZ Global management system for viewing and consolidation.

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Online working

Introduction

The online working model provides all of the same functions as the offline model. By adding the following additional components the system allows for remote monitoring and management and for Customers to buy water credits directly from the Water Operator.

- A Water Dispenser communications hub
- Integration to a mobile money provider
- A LORENTZ Global online account and monthly Water Dispenser management credits

Additional setup and configuration

The hub is installed within the water scheme. Depending on the size of the scheme more than one hub may be required. The hub provides LoRa connectivity to the Water Dispensers.

The hubs are registered by an approved LORENTZ partner who will install the configuration using an engineering smartphone app. The process is fast and secures the network dispensers to the Water Operator.

Users within the Water Operators organization have accounts setup on the LORENTZ Global platform by the LORENTZ partner.

Mobile money integration with the Water Operators wallet is handled either directly or through a 3rd party aggregator.

Customer introduction

Tags are issued to Customers within the community in the same way as for the offline model. At registration the mobile money details are also added to the Customer profile to allow payment for credits by mobile money.

Water Seller credit handling

Water Sellers can still operate locally in the online model.

Customer adding credit

The Customer sends a mobile money payment to the Water Operator, payment is confirmed and the credits are sent to all taps in the Water Operator network. The credits are added to the tag at the next visit.

System data

Each Water Dispenser sends real-time transactional and technical data via the LoRa to the hub where data is consolidated and sent via cellular services to the LORENTZ Global management system.

Offline and online transactions are combined to a single view in LORENTZ Global.

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Planning Considerations

Households per Water Dispenser

The number of Customers or households that a Water Dispenser will supports is based on the typical Customer water use and the pressure of the water at the dispenser.

Example

200 households in a community
6 persons per household
15l per person per day
Daily water to be dispensed is
 $200 \times 6 \times 15 = 18,000\text{l}$

Measuring the pressure at an existing tap shows 1 bar of pressure.

The dispenser will deliver 34l/min at 1 bar.

Assuming 6 hours of dispensing in a day $6 \text{ hours} \times 60 \text{ mins} \times 34\text{l} = 12,240\text{l}$ per dispenser.

So $18,000 / 12,240 = 1.47$ dispensers.

2 dispensers would allow this community to have their water needs dispensed in $(18,000 / (34\text{l}/\text{m} \times 60 \text{ mins} \times 2 \text{ dispensers}))$ 4 hours and 24 mins

Consideration should also be made on how water would be provided in the event of a failure. It is good practice to have multiple dispensers that are available within a reasonable travel distance if this is the only source of water.

LoRa communication

LORENTZ online Water Dispensers use LoRa to communicate on a local private network to the communication hub. The hub collects information and forwards data via cellular networks to the LORENTZ Global management system.

The major benefit of LoRa is that users setup their own wireless network for the dispensers. LoRa is a low power radio communication system that can reach long distances, but as with any radio technology it is very difficult to predict precise coverage.

Like any radio device large metal areas, metal roofs, very thick stone, concrete walls or sources of extreme electrical noise such as generators can effect range.

Hub location

The hub should be located centrally in the water scheme and dispensers should be within a 3 Km radius of the hub. If there is a line of sight between a Water Dispenser and the hub then the distance can be further. In testing LORENTZ has achieved distances of over 15 Km, but this must be surveyed to ensure reliable performance.

Dispensers per hub

Assuming that the dispensers are busy and probably serving 200 to 300 visitors per day then this generates significant data traffic.

In order to ensure good network performance, 20 Water Dispensers per hub should be planned. This can be increased if there are limited users and the number of transactions per day is significantly lower than 300 per dispenser.