

A Blockchain Platform for the Supportive Exchange of Data, Goods and Services

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ABSTRACT

Universal access to information and knowledge is the basic condition for improving the quality of life in developing countries.

Nowadays the sharing of information is made easier by the evolution and diffusion of Information and Communication Technologies (ICTs).

In this framework a web-based platform, the World Food Security E-Center (WFSEC), was developed by the University of Milan with the goal of fighting food emergencies by transferring competences and adequate solutions to rural communities.

In addition, we designed a blockchain structure for the WFSEC in order to allow a controlled exchange of the IoT data and to obtain a self-financing network by the exchange of tickets as electronic money.

Keywords

Teleconsulting, agrifood, cooperation, IoT, blockchain.

1. INTRODUCTION

The global connectivity and the cell/smartphone large diffusion allows to offer better life conditions for disadvantaged people and communities [1].

Driven by the urgent humanitarian needs highlighted by the OCCAM Observatory of Digital Communications and the Infopoverity Program (<http://occam.org>), the University of Milan realized the World Food Security E-Center, devoted to assist developing countries on rural development and urban nutrition, sharing knowledge and adequate solutions.

The software platform exists also as a Telemedicine service in the frame of the Program “Milan in the fight against hunger, malnutrition and related diseases” supported by the Municipality of Milan, serving as a consulting tool and health information exchange [2][3]. Telemedicine can be added in the future as further service of the integrated platform [4][5].

2. THE TELECONSULTING PLATFORM

The platform can be accessed after registration by Service Users (SU) and Service Providers (SP). The SU is the subject located in the developing country that collects data, images, signals manually or through IoT sensors located on the territory.

The SP is usually a University, research center or specialized laboratory that offers consultancies addressing the problems raised by SU (Figure 1).

The whole platform is coordinated by the WFSEC Hub manager, that can control the correct addressing and finalization of all the information transactions (Figure 2).

In particular, all the SU and the SP have the possibility to:

- view the global, personal and group activity stream, post directly their questions or sending a short message to other users;
- request or provide information, submit files or view the published ones [6] (Figure 3);
- provide courses uploading documents, images and links to videos, and attend them [7] (Figure 4);
- get or add contact infos of the SU or SP subscribed to the platform (Figure 5);
- manage or join a real time multiuser VOIP videoconference [8] (Figure 6);
- connect to a suitable channel for transmission of the Internet of Things signals coming from suitable sensors installed in the developing countries, yielding useful real time data (Figure 7);
- query the data repository to access all the data and the published information, and create reports and statistics [9][10] (Figure 8).

The online platform, as well as all the generated documents, can be accessed from PCs as well as from mobile phones, both on-line and off-line, providing a synchronous and asynchronous information exchange.

After the necessary testing phase and the involvement of a group of experts and laboratories, the platform is ready to be immediately available to all the users in the need of remote assistance.

3. IoT / BLOCKCHAIN EVOLUTION OF THE PLATFORM

We also studied a blockchain framework that applied to the WFSEC would be able to allow both the controlled and supportive management of the supplied data (especially IoT data) and the self-sustainability of the platform.

Blockchain is a network protocol that uses various technologies to create a chain of linked blocks. This chain is owned by all the nodes of the network and acts as a distributed database that allows the shared control of all transactions on an equal basis [11].

As for the above described platform configuration, we have so far two types of subjects: the SU and the SP.

At the core of this structure we have the Hub, central body that acts as guarantor for the whole network.

The screenshot displays the OCCAM Hub Manager interface. At the top, there is a navigation bar with the OCCAM logo and the text 'WORLD FOOD SECURITY E-CENTER'. Below this, there are several menu items: HUB, INFORMATION EXCHANGE, COURSES, MEMBER LISTS, GO TO MEETING, IOT, and DATA REPOSITORY. The main content area is divided into two sections: 'Service Users' and 'Service Providers'. Each section has a 'Join Group' button and a 'HUB MANAGER' button. The 'Service Users' section shows a list of members, with 'Chad' being the first member. The 'Service Providers' section shows a list of members, with 'Animals' being the first member. On the right side, there is a 'HELP: Member Lists' section with a search bar and a 'Log Out' button.

Fig 1: Service Users and Service Providers list

The screenshot displays the OCCAM Hub Manager interface, specifically the 'Hub' section. At the top, there is a navigation bar with the OCCAM logo and the text 'WORLD FOOD SECURITY E-CENTER'. Below this, there are several menu items: HUB, INFORMATION EXCHANGE, COURSES, MEMBER LISTS, GO TO MEETING, IOT, and DATA REPOSITORY. The main content area shows a 'Hub' section with a search bar and a 'Log Out' button. Below the search bar, there is a 'HELP: Hub' section with a search bar and a 'Log Out' button. The main content area is divided into three sections: 'News', 'My Groups', and 'Mentions'. The 'News' section shows a list of news items, with the first item being 'Request' submitted by 'Water' on Jun 14, 2017. The 'My Groups' section shows a list of groups, with the first group being 'Animals'. The 'Mentions' section shows a list of mentions, with the first mention being 'Treatment of animal disease Infos - Recommendations for the management of a breeding of chicks'.

Fig 2: The Hub manager log allows to control the flow of all the platform transactions

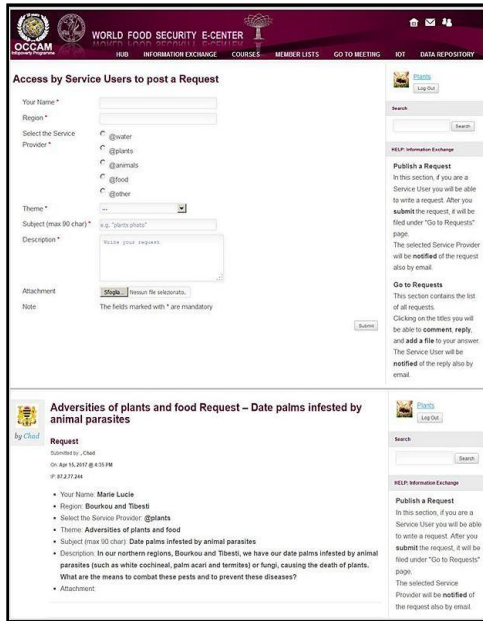


Fig 3: Posting of a Service User's requests

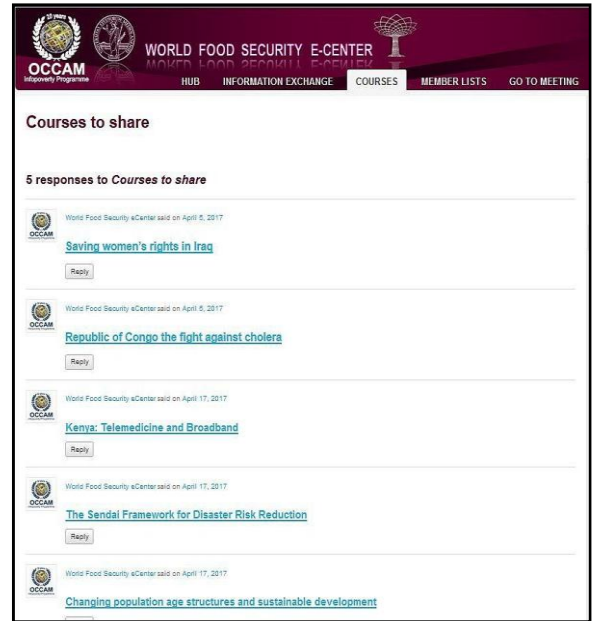


Fig 4: Available Courses

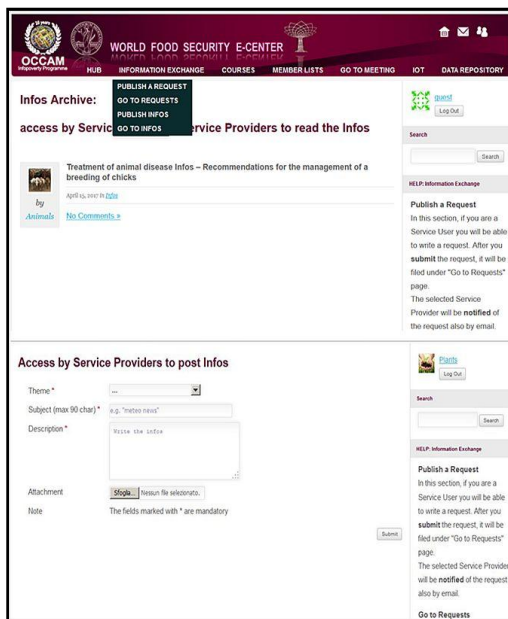


Fig 5: A menu allows Service Providers to post Infos or to answer the received requests

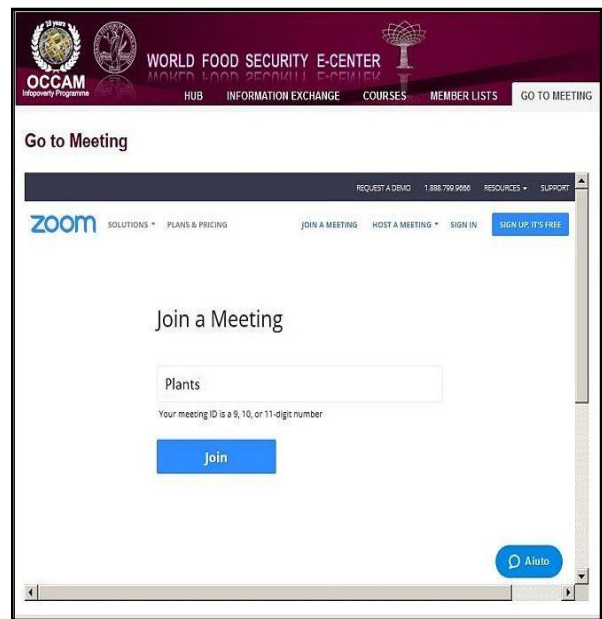


Fig 6: Videoconference access page

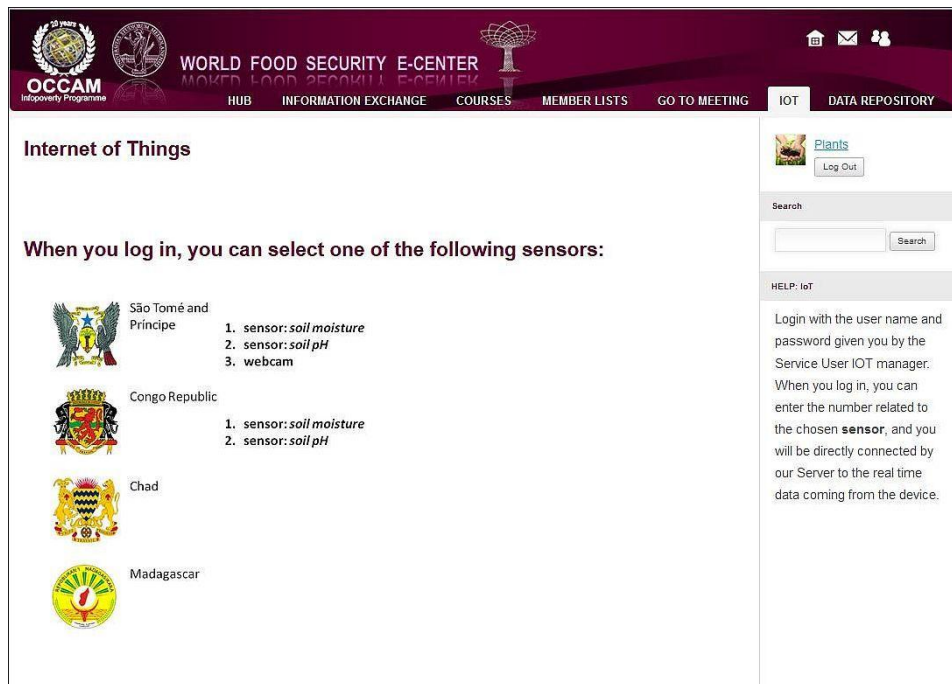


Fig 7: IoT channels. Data from sensors located on the Service Users territories are directly received by the platform server



Fig 8: Data repository

The new scenario prefigures a private blockchain platform in which not only data and information, but tickets that act as electronic money are exchanged [12].

The Hub has the task of verifying the correct occurrence of the exchange of tickets for the payment of the consultancies.

The novelty lies in the possibility to reach a self-financing network [13].

But it is also possible the introduction of new intermediate subjects, the Stakeholders (SH).

The infrastructure at the base of the network remains the same.

The Stakeholders (that can be also the Service Users selling their products) offer services and goods on the network, for them they require compensation. This fee is partly turned over to the Hub. The Hub then checks the amount of tickets present on the whole network and decides in which percentage to increase this number.

After which the costs paid to the relative Stakeholders are reversed, with the addition of a premium proportional to the paid tickets (Figure 9).

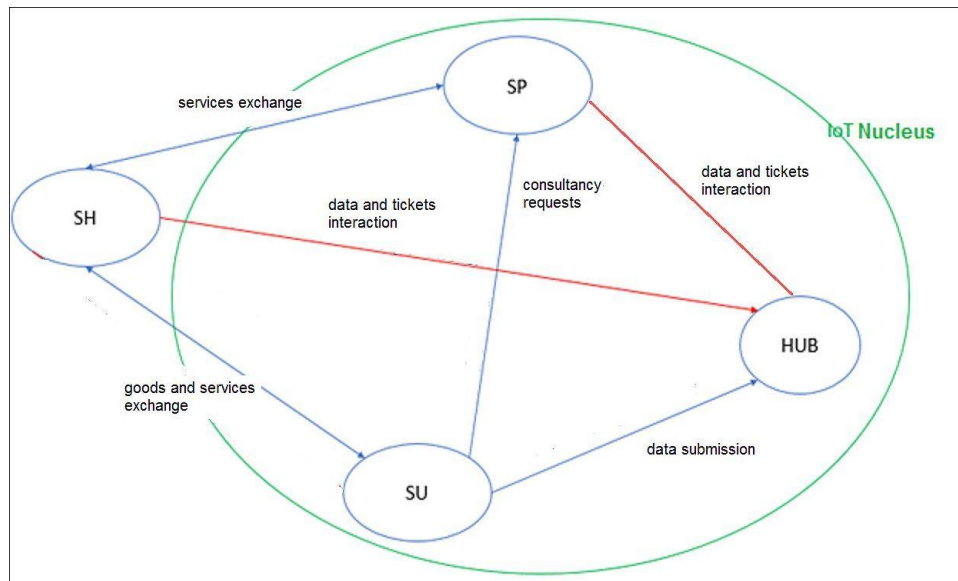


Fig 9: Evolution of the platform: Blockchain tickets exchange

These awards allow services and goods to be more accessible as costs decrease, or the provider can get the resources necessary to improve the service/good offered.

The software platform maintains the same architecture, but the request form becomes for example as in Figure 10.

Access by Stakeholders to post a Request

Your Name or business name *

Name or business name of the seller *

Region *

Select the product * @busticket
 @animals
 @hospital ticket
 @food
 @other

Quantity *

Description *

Attachment Nessun file selezionato.

Note The fields marked with * are mandatory

Fig 10: New request form including exchange of good and services to be paid through Blockchain

There are other advantages offered by the blockchain framework:

- in the IoTs network, the blockchain itself allows to guarantee and authenticate the data exchanged between smart devices;
- the blockchain could also act as guarantor for the exchange of renewable energies between individuals without consulting a centralized intermediary;
- it also allows point-to-point control of donations, as the blockchain itself guarantees that the transactions reach the correct target without intermediate manipulations.

In summary the data exchange supported by the teleconsulting platform activates a self-controlled ticket movement [14]. The virtual money can be exchanged with regular currency, but

has the advantage not to face currency exchange problems among countries, allowing simpler product selling procedures.

The blockchain platform extends the application context to the whole world, allowing the exchange of any kind of good and services, included data and knowledge, by means of the exchange of tickets passing through the Hub [15]. Thus any Service User can benefit from the platform usage.

4. CONCLUSIONS

We developed a web-based platform able to support farming communities in the developing country by means of a network of experts. The knowledge can be shared and remains at disposal for future needs, increasing in time. The platform can be accessed from any device and can manage data coming from remote IoT sensors.

Blockchain technology may be applied to the web platform in such a way as to allow agrifood operators in remote countries to exchange not only knowledge but also goods and services in a supportive framework [16] [17]. A central Hub acts as a guarantor and shares awards among all the users allowing an easier access to services and goods. In the meantime, the underlying teleconsulting platform allows the agrifood operators to access high-level knowledge to improve their work [18].

The model can be easily implemented and would allow the self-sustainability of the platform.

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