SAIRA – The Open Innovation Hub for Sustainable Development

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Global challenges like climate change, food security, and infectious diseases such as the COVID-19 pandemic are nearly impossible to tackle when established experts and upstart innovators work in silos. If research organizations, governments, universities, NGOs, and the private sector could collaborate on these challenges more easily, lasting solutions would certainly come more quickly. Aligned with the United Nations' Sustainable Development Goals, SAIRA connects key players in different arenas: scientists and engineers at research and technology organizations (RTOs) looking to collaborate on sustainable development projects, companies seeking R&D support to tackle their most challenging problems, and startups with innovative ideas and a desire to scale. The platform is a blockchain-secured open innovation platform, anchored on Max Plank Digital Library's blockchain network bloxberg, that assures the authenticity and integrity of all user-generated content and collaboration processes.

1. Introduction

The United Nations' Sustainable Development Goals (SDG) [1] address the major challenges that people from developing countries and the planet are currently confronted with. The 17 SDGs have been adopted by all United Nations Member States and highlight a series of objectives such as ending poverty, improving health and education, spurring economic growth, and tackling climate change. Such goals are to be achieved in a global partnership by both developing and developed countries. The World Association of Industrial and Technological Research Organisations (WAITRO) [2] helps with bringing the SDGs to fruition. WAITRO's mission is to connect science, technology, and innovation stakeholders such as universities, research institutions in order to share their solutions and tackle global challenges such as the SDGs.

The SAIRA® platform was developed for the purpose of connecting researchers, companies**,** and organizations to share ideas, forge partnerships, generate synergies and promote technology. Members of the WAITRO have been using the SAIRA® Open Innovation Hub since early 2019. With SAIRA 2.0**,** we have extended the platform to a digital gateway for R&D service providers from around the world that enhances collaborative innovation. It focuses on international collaborations for the SDGs, is guided by principles of inclusiveness – publicly available and free of charge, and designed to deliver applicable solutions with benefits for societies and economies**.**

This paper presents the relaunched version of the SAIRA platform by highlighting its key features:

- An intuitive user interface that facilitates easy matchmaking between solution seekers and innovation providers
- Blockchain integration to secure the user-generated content and protect the intellectual property of the authors
- A self-sovereign identity concept to manage the actors' identities and data

The paper is structured as follows. After the introduction, a general overview of the platform is offered, with section 3 including more technical aspects of the architecture. Section 4 goes into detail about the blockchain integration, before the conclusion wraps up the results and provides some incentives to join the platform.

2. Platform Overview

The main purpose of SAIRA is to connect innovative ideas with knowledge and technology. Visitors of the SAIRA platform can browse published opportunities and search for opportunities that may be of interest and match their professional background (cf. Figure 2). To find ideal collaboration partners for implementing project ideas, a wizard guides SAIRA users through the creation of an opportunity.

In the first stage, an opportunity consists of an abstract that summarizes the challenge, the research areas targeted, and optionally a deadline for proposals. If the solution seeker is applying for a grant, (s)he should inform its collaborators about the respective timeline. Furthermore, the user may provide an in-depth description of the challenge and specify the expected contribution of the partners, as well as their expected geographical location.
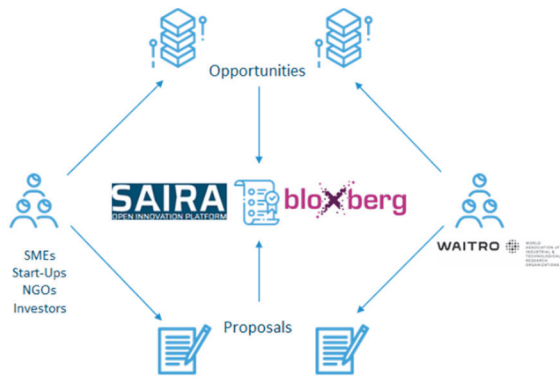
Fig. 1: SAIRA the matchmaking platform

When a SAIRA user finds an opportunity of interest and wants to contribute, (s)he can propose an idea towards tackling the opportunity. The proposal must include a detailed description on how to contribute, as well as information about the professional background of the author and his/her expertise. For initial clarifications, the user can contact the author of the published opportunity. When the user submits the proposal, the author of the opportunity receives an email notification and gets access to the proposal. Ultimately, the author of the opportunity may connect with the author of the proposal and start a collaboration by accepting the proposal.

The platform additionally offers the users a community panel where the profiles of platform users can be browsed, thus facilitating finding collaboration partners. During opportunity and proposal preparation, users can invite partners to their project and collaboratively develop their project idea.

SAIRA uses the Bloxberg blockchain to secure the submitted proposal against manipulation and to guarantee the authenticity and integrity of all registered data. Also, the acceptance and rejection of a proposal is protected by the bloxberg blockchain and respective transactions can be retrieved at any time.
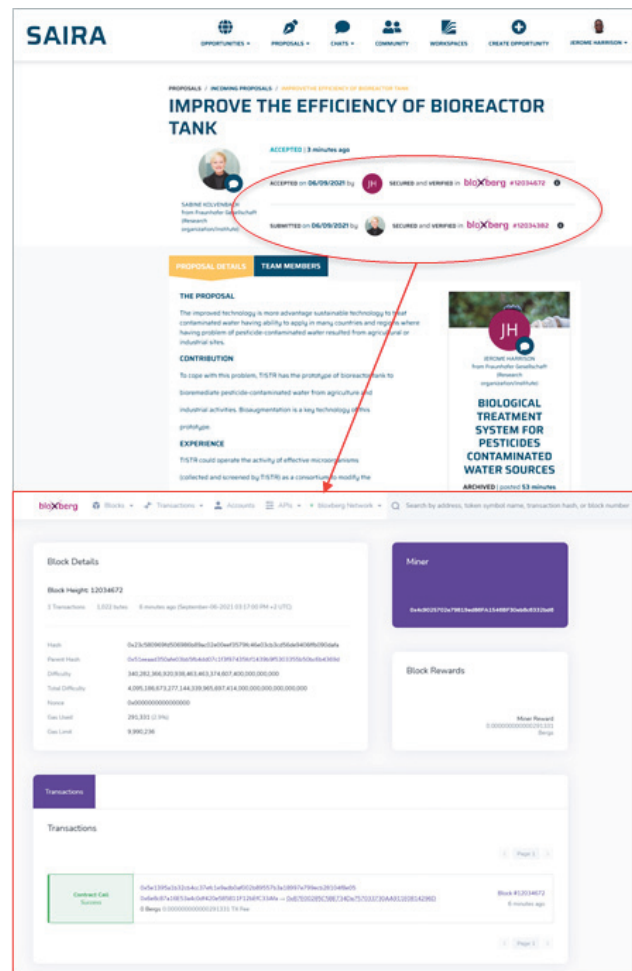

Fig. 2: Proposal submitted to an opportunity and secured in bloxberg

3. Platform Architecture

The SAIRA frontend has a responsive design; it is implemented in Angular and Bootstrap and integrated with the SAIRA backend and the bloxberg blockchain through a REST API.

SAIRA® is an adaptation and extension of the BSCW Shared Workspace System. BSCW [3] is continuously developed jointly by Fraunhofer Institute for Applied Information Technology FIT and Orbiteam GmbH & Co. KG [7] and has been successfully marketed by Orbiteam GmbH & Co. KG for more than 20 years.

The blockchain used to secure the application content is bloxberg, a worldwide network of research organisations that provides scientists with decentralized services for research collaboration. The network was launched in 2019 by the Max Planck Digital Library. Thanks to the blockchain properties of decentrality, coordinated consensus, and transaction validation, various services that are decentralized by nature are enabled, such as supporting research claims, paper peer review, research data certification, etc.

bloxberg is developed as a permissioned Ethereum blockchain and functions based on a Proof by Authority

consensus, i.e., the AuRa algorithm [8]. Ethereum is currently the most widely used blockchain technology, supports a relatively large number of decentralized applications (dapps) and has been proven to be resilient and stable against attacks.

4. Blockchain Integration

The blockchain backend of the platform fulfills the function of a notary. At its center, it has smart contracts that implement the business logic. Besides securing the hash of a contribution in the blockchain, the smart contracts provide functions to retrieve the stored content, both in its current and previous versions (cf. Table 1).

name	function
save	stores a proposal record in the blockchain
latest	retrieves the latest proposal record given a proposal id
versionCount	retrieves the proposal record that matches the proposal id and version index
pastVersion	retrieves the proposal record that matches the proposal id and version index
id	returns a list of proposal ids and version indexes that match the checksum provided

Table 1: The features implemented by the smart contracts

The main smart contract uses a storage contract for saving its data, which prevents any data loss in case of an update of contract's main functions. The storage contract provides a key-value storage for the basic data types by mapping the hash of the variable to its value. More complex data types, e.g., arrays, mappings, are stored using the same key-value mappings, in addition to which the name and size of the structure are likewise stored.

The smart contracts are deployed over a non-authority node to the bloxberg network dedicated to dapps. The interface to the blockchain functionality is realized by a REST API that forwards the requests to the main smart contract (cf. Figure 3).
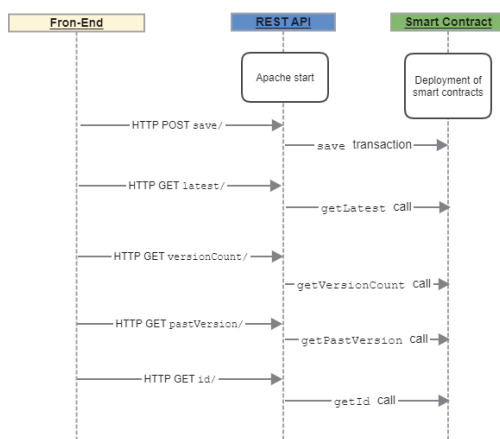

Fig. 3: A sequence diagram shows the request flow in the system

The smart contracts and the API are bundled as two containers in a docker-compose environment. The smart contracts are written in Solidity. Their compilation and deployment are performed using the web3 library. The REST API is run as Apache server and is implemented in Python using the Flask library.

With the advent of self-sovereign identity, extensions to the blockchain model can be implemented. The platform users can be assigned decentralized identifiers (DIDs) which wrap around the public/private key pairs that are used to sign content and for user verification. In return for submitting contributions to the platforms such as opportunities and proposals, verifiable credentials (VCs) can be issued by the platform to certify the user's contribution. The VCs are to be stored in the user's wallet and can be presented as evidence for the submitted content. The DIDs are stored in the ledger, so that the signature verification can be performed with public data (cf. Figure 4).
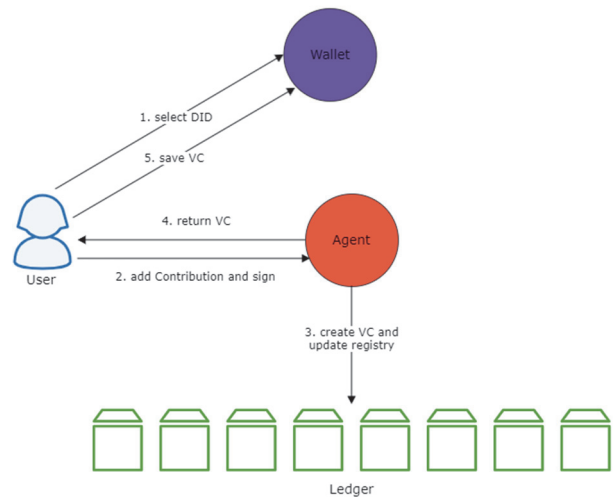

Fig. 4: SSI-enhanced model for SAIRA

5. Conclusion and Incentives to Join

The redesigned platform follows the over 50 success cases of small bilateral cross-border collaborations that were achieved with the previous platform version in 2019-2020. Since the relaunch in June 2021, more than 360 users have registered on SAIRA and more than 50 opportunities with innovative project ideas, local challenges, and collaboration needs have been published. Using a blockchain backend that backs up the proposals in one of the world's fastest growing research networks, bloxberg, SAIRA is aiming to add more features in the future in order to facilitate more matches and help advance the United Nations' Sustainable Development Goals.

WAITRO offers incentives to start using the new SAIRA platform, such as the WAITRO Innovation Award [5]. Two project teams who match on SAIRA get the chance to win 25.000 USD seed funding and training. This year's Innovation Award focuses on solutions that contribute to

food security and sustainable agriculture (SDG 2-Zero Hunger). Moreover, WAITRO provides support for consortia matched on SAIRA that are planning to submit proposals to the highly competitive Horizon Europe program by financing external reviewers who examine applications and offering guidance on research ethics and equitable partnerships [6].

Acknowledgements

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