

WalletCHAIN

The Next Generation of Digital Wallets Enhanced
by Artificial Intelligence

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Global Trust Foundation
“Solving Complex Issues – Simply”

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1.0 INTRODUCTION

In compliance with eIDAS 2.0 regulations, Digital Wallets bring enhanced efficiency, security, and privacy, empowering citizens with greater control over their personal data when using trusted credentials (such as passports). These wallets ensure predictability in transactions offering heightened safety, efficiency, and potential cost savings, especially in more intricate workflows, such as those requiring multiple approvals for financial loan applications and approvals.

In the spirit of true democracy for personal data protection, envision a scenario where data exchange mimics the simplicity of trading banknotes, devoid of regulatory interference beyond the involved parties during the transaction.

A regulatory-focused Closed Wallet will be deployed initially to citizens by all Member States. However, Open Wallets which operate within the 'contractual domain' address Consumer to Consumer, Business to Consumer, and Business to Business needs. These wallets, governed by pre-agreed terms and conditions (Rules of the Game), can offer flexibility and assurance akin to conventional Commerce. They support diverse data interactions, including financial and non-financial components, between individuals and/or entities, fostering intricate processes and interactions.

The success of transformative societal change relies on widespread technology adoption and trust in it. Unless the utilisation of Open Wallets and their complex workflows becomes easily understandable, the democratisation of personal data through digital wallets will face challenges. The updating of digital wallets with a conversational AI aims to extend the state-of-the-art of existing wallets with the purpose of reducing the risk of financial fraud and psychological misery caused by scam bank transactions. Additionally, the objective is to increase the use of digital wallets among the public through decentralised, trustworthy and easy-to-use contracts generated by the AI for real-world use-cases facilitating efficient consumer-to-consumer, consumer-government, consumer-business, and business-business. In this way, the general public's digital literacy is expected to be improved by walk-throughs in the process of using digital wallets for everyday transactions and contracts. The fraud reduction will involve leveraging existing scam avoidance schemes in the contract process by slowing down the decision-making process by the 'transactor' to ensure the transaction is precisely the desired contract.

Natural language AI-driven workflow generators, accompanied by ethical, interoperable templates and standardised terms, will simplify necessary everyday transactions, making wallets exceptionally user-friendly and more convenient for non-technical individuals and small businesses to define and implement workflows in wallet-based interactions. They will encourage a transformative shift in how individuals and entities locally and virtually interact and exchange their data.

Please note that in many wallet solutions “workflows” are also described as “Applications”.

2.0 CONCEPTS AND OBJECTIVES

In compliance with eIDAS 2.0 regulations, Digital Wallets bring enhanced efficiency, security, and privacy, empowering citizens with greater control over their personal data. These wallets ensure predictability in transactions, offering heightened safety, efficiency, and potential cost savings, especially in more intricate workflows. However, the conventional Wallets, as envisaged in the Large-scale Pilots require varying degrees of government credentials and involvement and concentrate on Consumer to Government actions.

The concept is to leverage the eIDAS 2.0 call for a Digital Wallet to be made publicly available by Governments and optimise the technology stack that is widely available. This provides an invaluable opportunity that exists for EU citizens to establish new ecosystems with unique, trustworthy 'rules of the game' (terms and conditions) for any chosen specific interactions. These could vary from simple buy/sell to operations of an e-marketplace that facilitates the exchange of digital assets within its own contracts and service level agreements.

The scope and size of the ecosystems are limitless, hence the main objective for the Digital Wallet is to become a single entry point for citizens and companies to exercise their sovereign will in one to one and one to many interactions.

The application is conceived in a way so that the personalised workflows are assembled by a trustworthy natural language AI which can utilise existing templates and components ethically, and in time may assemble its own complex structures. It is expected that zero-knowledge proofs will be important in fulfilment acting as triggers for next-steps in the workflows.

Identity level of assurance will be one of the factors determined by the ecosystem rules, as well as maintaining compliance with any chosen regulations. All workflows will be monitored for ethical processes (privacy, security and personal data protection) to ensure limits with risk mitigations, and limiting criminal and antisocial outcomes.

As any interaction can be established and designed by an individual or a company, there is full opportunity for creativity and expression. The inclusion of finance mechanisms adds another dimension to establish new ways of barter or exchange.

As the intention is to accumulate a large and increasing library of components, triggers, interfaces etc, opportunities for exploitation (maximising use) are exponential.

Operational capability and financial viability will be enabled through a democratic choice for the users of each workflow, with options such as pay-per-use, up-front fee, etc. A cost of operation will be calculated as part of the workflow assembly process.

The outputs of the application will be in a standardised format and can be incorporated into interfacing digital wallet modules. The platform itself will eventually be decentralised.

3.0 THE SOLUTION

Concept relevance to current challenges

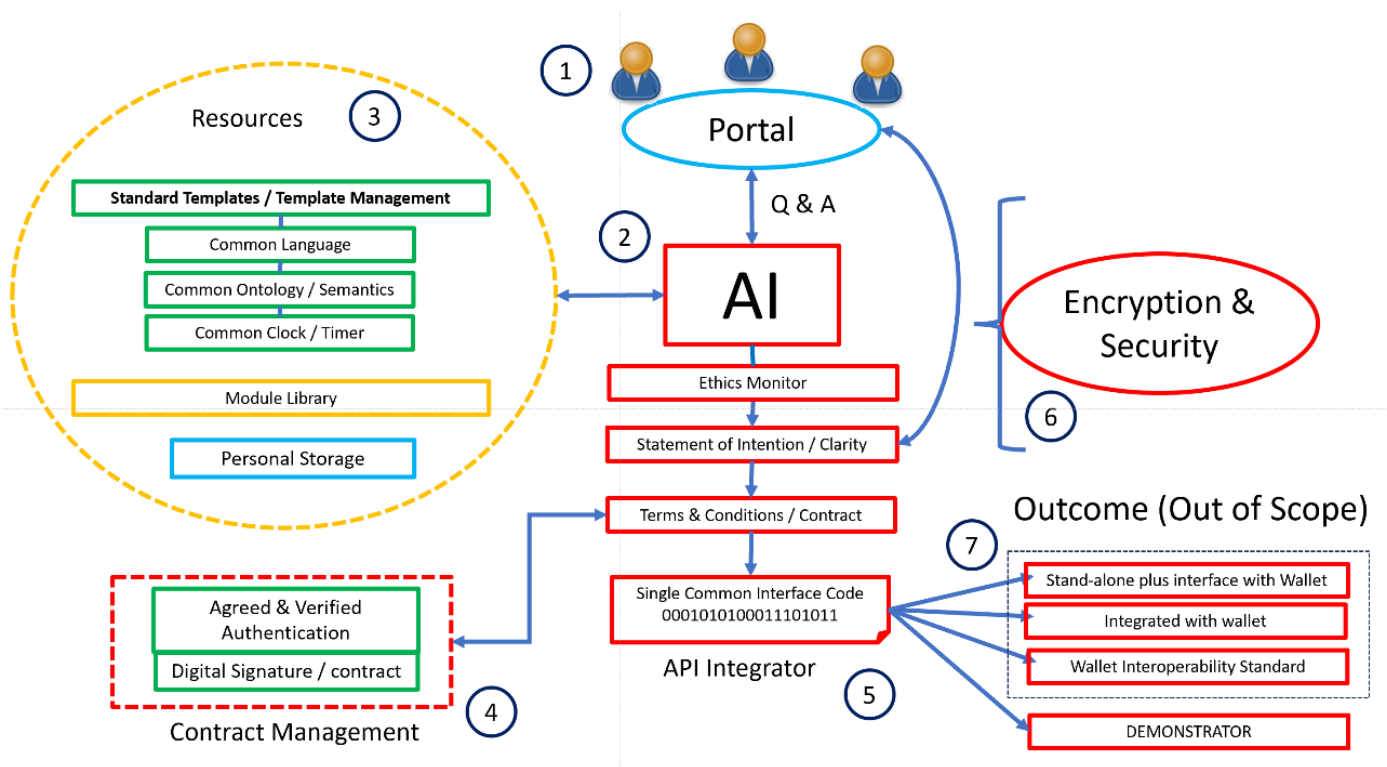
An evolved Digital Wallet with enhanced trustworthiness features incentivising EU citizens to use the wallet for their everyday transactions with other citizens and businesses. The proposed solution meets the objective of a decentralised environment for citizens to conduct their necessary transactions in an easy-to-process manner. The Wallet would follow ethical principles of preserving privacy and protecting personal data from unnecessary surveillance.

The originality is implementing AI in its design through a ‘safeguarding’ philosophy and adding a convenience layer of a natural language FAQ tool to assist in transaction processing.

The eIDAS regulation calls for a digital wallet to be offered to each EU citizen. The regulation allows for the use of the digital wallet in B2B, B2C, and C2C use cases. However multiple parties, and issues of privacy, consent, and regulatory complexities will require legally binding and trust workflows to control any agreement, whether it is the paid provision of consent for data sharing or physical transactions between groups of individuals. This proposal will provide a robust method for non-technical individuals and organisations to create and initiate their own potentially complex workflows safely, for example entering into a personal loan contract.

Solution Description

Figure 1 shows the key components described below.



1. A communication portal with user interfaces suitable to deploy across desktop PCs or mobile devices.
2. The core AI component builds the workflow by collecting the criteria from the user via (1) and applying resources (3). The AI will conduct text or conversational Q&A with the user and establish a workflow suggestion. It will be passed via an ethics filter/monitor for safeguarding, transparency and restated to the user to ensure the workflow is 'fit for purpose'. This will involve a 'sign off' for clarity, consent and intention by the user.
3. The resources component will provide key modules to be used by the AI for efficiency, and consistency of basic workflow functionality, and specialised modules from an expandable library such as consent management, proof of delivery triggers, etc. There will also be a library of templates built up over time which can be re-used for building the basis of common workflows.
4. Once the workflow is approved by the user in (2), terms and conditions as well as any legal criteria and required assurance levels will be added to form a complete workflow with all components.
5. The completed workflow and contract will be translated into a single common code smart-contract that then can be utilised by the target wallets. This common code provides interoperability between different wallet types (e.g. eIDAS, or eIDAS compliant) and brands.
6. Most components use mature techniques and existing methodologies in their construction. The AI components, and in particular the ethics monitoring will be original and a novel addition enhancing trustworthiness of Open Digital Wallets. Additionally, they will be based on natural language processing, increasing the long-term relevance and sustainability in general. The maturity of the solution as a whole will depend on the number of additional modules that are added into the library. In the longer term, possible modules could include (but are not limited to): the following modules (e.g. payment provider interface, see Table1).

Logs/ Audit	User Payment Interface	Proof of execution / triggers	Zero Knowledge Management
Payment Provider Interface	Dispute interface	Rollback/Resilience register	
Bourse Capability	Consent Management	Arbitrage Management	

Table 1 Partial Modules List

Ethics and Privacy

Ethical citizen science will take into consideration the principles of citizen science engagement from the European Citizen Science Association (ECSA). Ethics monitoring will include complying with the GDPR firstly gaining consent and engaging citizens as volunteers, through interviews and forum discussions, to ascertain the types of transactions that could be activated in a digital wallet. Understanding users' needs will facilitate design of the natural language 'helper' in the digital wallet. Secondly, the ethical approach will involve exploring current large language models, such as BARD, ChatGPT, CLAUDE, GROK and e-commerce dialogue systems (chatbots), to implement the most trustworthy and easy-to-use for a novice citizen natural language AI through an API in the digital wallet. Ethical approval to engage volunteer citizens will be gained through an application to the ethics research panels of universities.

4.0 EXPECTED IMPACT

Challenges Addressed

WalletCHAIN is an end-user driven privacy-by-design approach to extending the state-of-the-art in current digital wallets by embedding easy-to-follow workflows facilitated by a natural language FAQ tool (conversational AI) for convenience and transaction walk-throughs. In this way, a member of the public would improve their digital literacy in an informal way while learning about their rights to personal data protection and privacy preservation granted in EU regulations (e.g., GDPR, ePrivacy Directive, Digital Services Act, EU AI Act). Concomitantly digital wallets would increase in use as the technology is exploited. The project addresses the challenges below:

a. *Data trading and exchange raise significant concerns about data privacy and security:*

The workflow contract generated can be customised to meet a range of privacy and security issues, being able to utilise Zero knowledge proofs as part of the agreement. Execution of the agreement can either be triggered by the workflow or monitored as having occurred. Exchange of value (token, financial, or in-kind) can be included in the workflow. The origination of the workflow can either be the ownership of the seller, or as an offer from the buyer.

b. *Establishing enforceable data marketplace contracts for data exchange is missing:*

The workflows can be constructed as legally binding documents. Additionally other triggers can be enforced which could kick in automatically issued penalties. For example, a proof of execution/trigger module could potentially police indicators or usage outside of agreed limits.

c. *Establishing clear data governance practices, including data access controls and usage policies, is essential for responsible data exchange.*

While this challenge is strictly outside of the scope of this proposal, enforcement of the challenge is possible as described in (b).

d. *Digital solutions to enhance civic mobilisation and engagement.*

There is no standard pricing model for data, making it challenging to determine the fair market value of different data types. The concept of the Digital Wallet is that *all* citizens and organisations can interact in a safe and trusted manner. When combining this asset with the ability for establishing flexible and democratic workflows easily and consistently, civic movements can be established and upheld from the 'sell-side'. The use of workflow templates encourages mass distribution of patterns of action across like-minded segments of the population and can provide suggested market driven pricing.

Industrial Impact

Society has evolved over many centuries through ever more sophisticated barter and exchange of services and goods. These have continued to be mainly bilateral transactions even as these interactions have become online and digital. Digital wallets, and the workflows they enable, offer the ability to expand interactions to become multilateral and dependent on complex actions.

For this capability to achieve a large industrial impact (as well as a large societal impact) there needs to be a large-scale uptake. Recognising that the majority of businesses are SMEs and many will not

have strong IT technical skills, if any, a simple and comprehensible way of creating the custom workflows needed to accommodate a large segment of even the smallest commercial transactions, is a necessity. This project aims to build this mechanism.

The impact of being able to conduct complex activity will be to fundamentally evolve how business could be conducted, even by geographically remote SMEs to gain business intelligence. By utilising this innovation, the entire transaction chain can be revolutionised and enhanced, making business safer, faster, and financially more robust, using fewer staff, all while broadening its reach.

Industrial Impact Example:

An SME that conducts logistics transportation wishes to monetize its (partially anonymized) statistics that it accumulates as part of its daily operations. The regional Highways Agency needs transportation statistics for planning road improvements. The local federation of transportation companies, of which the SME is a member, establishes a data hub where anonymised data can be accumulated from its members and provided to anyone requiring these detailed statistics. They provide their members with an application (a workflow) for their digital wallets so that data can be transferred in return for payment. The wallets are already verified as belonging to a valid company, and part of the workflow involves a transfer of a formatted set of data. When that data has been received, verified as correctly formatted and forwarded in bulk to the regional Highways Agency, the workflow having been flagged with all these milestones, waits for payment from the Agency, and when this occurs, payment is made to the SME. All this is done automatically and to verified members using Zero Knowledge Proofs to provide auditability to all. In this way business statistics can be shared without risk and monetized efficiently.

For use with organisational digital wallets, a limited target sector could be established to test the uptake together with a pre-arranged consumer or group of consumers. A simple workflow type could be set up, measuring the ease of creation and the desire to uptake the concept. Testing will require Digital wallets which could initially utilise personal versions depending on availability. Depending on the size of the target sector and number of consumers, ease of workflow creation (subjective opinions measured between 0-9) and uptake (% of sector) could easily be measured. Target results of uptake would be proportional to the awareness building efforts with a >10% uptake of those directly approached being a realistic 'early adopter' level. It should be emphasised that for this project specifically, the automated workflow components will be based on stubs initially. The deployment of wallets will need to be bespoke, as wallets will not yet be in widespread use within the project's timeline.

Acknowledgements

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