

Enabling Dynamic Consent Through AI and Blockchain: The CONSENT Platform

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Abstract. The increasing complexity of data ecosystems, especially healthcare, highlights the urgent need for dynamic, user-centric consent management solutions. Traditional static consent models struggle to adapt to evolving privacy regulations, organizational needs, and user expectations. The CONSENT project introduces an innovative Consent Management Platform (CMP) that leverages Artificial Intelligence (AI) and Blockchain technologies to enable secure, transparent, and flexible management of consent in complex data workflows. By combining intelligent consent recommendation mechanisms with tamper-proof decentralized storage, the CONSENT platform aims to empower users with greater control over their data while facilitating organizational compliance with frameworks such as GDPR and CCPA. This paper presents the platform's vision, core technological pillars, and the planned evaluation strategy, including the anticipated implementation in healthcare and digital services, providing insights into how AI and Blockchain can reshape consent management for the healthcare digital age and beyond.

Keywords. Consent management platform, dynamic consent, blockchain, artificial intelligence, GDPR compliance, data privacy, user empowerment

1. Introduction

The management of user consent for data collection and processing has become a fundamental requirement in the digital era, including healthcare. With the introduction of stringent privacy regulations, such as the General Data Protection Regulation (GDPR) in Europe [1] and the California Consumer Privacy Act (CCPA) in the United States [2], organizations must now ensure that consent practices are transparent, flexible, and verifiable. In healthcare settings, informed consent is typically acquired once before treatment begins, often through static paper forms or digital equivalents. This one-time approach is increasingly insufficient, increases the risk of non-compliance and erodes

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user trust, especially as health data is reused in research, shared across systems, or subject to evolving legal and ethical guidelines.

Dynamic Consent Management (DCM) has emerged as a promising paradigm to address these challenges [3, 4] by offering users the ability to adjust, update, or revoke their consent over time. However, implementing such flexible consent mechanisms requires advanced technological solutions capable of ensuring both transparency and scalability. Recent research highlights the potential of Blockchain technologies to provide immutable, decentralized consent records [5, 6], and the use of Artificial Intelligence (AI) for adaptive consent lifecycle management [3, 7]. Blockchain offers tamper-proof audit trails, supporting regulatory compliance [8], while AI can automate and personalize consent workflows, reducing administrative burden and human error in the healthcare domain.

The CONSENT² project addresses emerging data governance needs by developing a next-generation Consent Management Platform (CMP) powered by AI and Blockchain. By offering intelligent consent recommendations and secure, decentralized tracking, CONSENT empowers users to control their data while helping organizations ensure compliance. This paper outlines the platform's vision, approach, and expected impact, positioning CONSENT as a foundation for trustworthy, adaptive consent management in the healthcare digital era and beyond.

2. Methods

2.1. CONSENT Project Overview

The CONSENT project delivers a next-generation Consent Management Platform (CMP) that overcomes the limitations of static models by introducing a dynamic, intelligent, and secure approach. With growing regulatory demands like GDPR and CCPA [1], organizations need flexible systems that support ongoing, user-driven consent updates and revocations. While other solutions focus on secure information sharing and consent recording, the CONSENT platform advances the field by combining AI-driven consent personalization, predictive lifecycle management, and blockchain-based smart contract enforcement, offering a fully adaptive, user-centered and scalable consent management ecosystem.

Drawing on the DCM [3, 4] paradigm, CONSENT empowers individuals with greater data control by integrating advanced AI for consent recommendations, lifecycle prediction, and anomaly detection [7, 9], along with blockchain to ensure tamper-proof consent records [5, 6]. The project's core objectives, as depicted in Figure 1 are:

- To enable real-time, fine-grained control over consent by data subjects and patients.
- To ensure secure, transparent, and immutable consent logging leveraging blockchain-based smart contracts [8].
- To automate and personalize the consent process via AI-driven insights [7].
- To enhance regulatory compliance by offering verifiable consent management pathways [8].

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The CONSENT platform is being developed through a multidisciplinary collaboration between academic institutions and technology companies, combining expertise in data security, AI, blockchain applications, and user-centered system design. The platform design is to be informed by stakeholder consultations and co-design sessions with representatives from healthcare, legal, and IT sectors. The resulting platform is envisioned to address critical gaps identified in previous studies [3–5] and meet the growing demand for ethical, scalable consent management solutions across sectors such as healthcare, finance, and digital services.

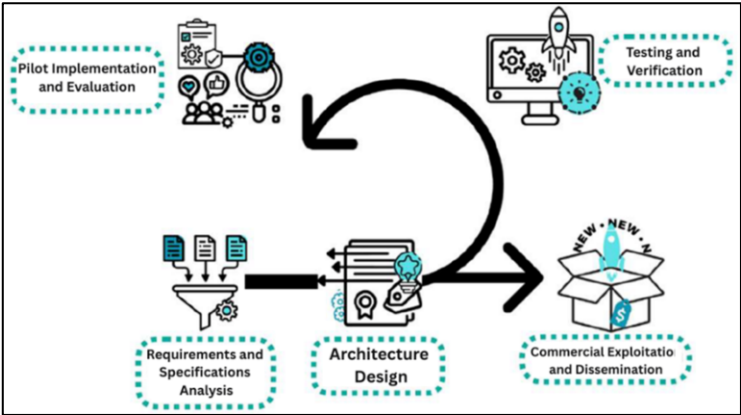


Figure 1. CONSENT Implementation Methodology.

2.2. Technological Approach

2.2.1. Artificial Intelligence for Adaptive Consent Management

AI techniques play a central role in enabling the dynamic management of user consent preferences. The CONSENT platform will leverage AI-driven models to analyze user behavior patterns and predict potential consent updates, recommend optimal consent settings based on contextual information and user profiles, detect anomalies in consent workflows that could indicate unauthorized changes or breaches, and to automate the process of consent form generation based on the use of pre-trained models. Machine learning algorithms, particularly those based on user profiling and predictive analytics, will help automate the consent lifecycle, reducing the administrative burden on both organizations and users. Moreover, AI will allow the personalization of user interfaces, enhancing user experience and engagement.

2.2.2. Blockchain for Secure, Tamper-Proof Consent Logging

Blockchain technology provides the CONSENT platform with decentralized, immutable recording of consent actions. Smart contracts will be employed to automate consent enforcement policies and ensure that each consent action, granting, updating, and revoking is securely and transparently recorded. The main Blockchain-related functionalities include Immutability, where Consent records are tamper-proof and verifiable by all authorized stakeholders. Transparency, where every consent-related transaction is traceable, improving accountability. And automation, meaning Smart contracts that allow automatic triggering of events (e.g., blocking data access after consent revocation). A permissioned Blockchain network architecture is envisioned,

ensuring scalability and compliance with GDPR ' s requirements for lawful data processing.

2.2.3. System Architecture Overview

At a high level, the CONSENT platform is structured into three main layers (Figure 2):

- Consent Collection Layer: Interfaces for users and organizations to input, update, or revoke consent.
- Dynamic Management Layer: AI-Driven Modules responsible for consent recommendations, lifecycle monitoring, and personalization.
- Decentralized Storage via Blockchain Logging Layer: Immutable, secure ledger of all consent transactions.

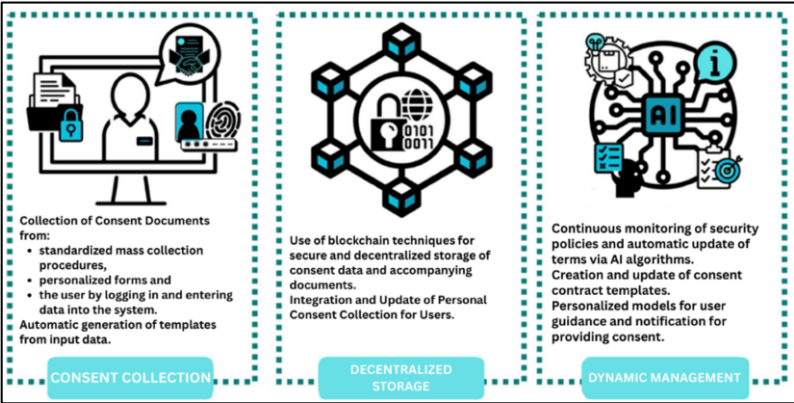


Figure 2. Lifecycle stages of CONSENT requests/consents.

2.3. Dynamic Consent Management Concept

The CONSENT platform reimagines traditional consent management by embracing the principles of DCM. Unlike static, one-time consent models, CONSENT introduces a continuous, user-driven approach that enables real-time updates, fine-grained permissions, and transparent tracking. Consent is treated as an ongoing, adaptive process where users can not only provide but also modify or withdraw consent at any time. They can specify consent by data category, purpose, or recipient, and monitor how their data is used.

Recognizing that user preferences evolve over time, CONSENT advances existing dynamic consent frameworks by integrating AI-driven consent personalization, blockchain-based consent recording, and granular management tools. It also supports real-time policy updates without disrupting ongoing data processing, ensuring both operational continuity and user autonomy. In healthcare, the platform addresses key challenges in managing patient consent dynamically. Patients can adjust consent scopes (e.g., from research to internal analytics), revoke data-sharing permissions, or reconfirm consent following policy changes. For example, a patient may initially agree to data sharing for analytics but later revoke access for third-party research—this change is instantly enforced and immutably logged via smart contract.

3. Results

The CONSENT platform will be evaluated for its ability to empower users, ensure compliance, and maintain transparency and technical reliability. Evaluation will include technical validation, focusing on Scalability, blockchain speed, AI accuracy, GDPR / CCPA compliance. Usability Testing, where the consent management ease, interface clarity, and user satisfaction will be evaluated. Security and transparency assessment, focusing on tamper-proof records and verifiable consent histories. Lastly, implementation feasibility via focus groups and interviews with healthcare professionals, legal experts, and system integrators will take place, along with pilot tests in sectors like healthcare and digital services to assess flexibility and scalability.

4. Discussion and Conclusions

The CONSENT project introduces a dynamic, intelligent, and secure approach to consent management, addressing the shortcomings of static models through AI and Blockchain. In healthcare, it supports patient empowerment and enhances trust while complying with legal mandates. The user-centered platform aims to make dynamic consent a natural part of digital interactions. Upcoming pilot evaluations will shed light on its real-world impact, informing future practices in privacy, data governance, and digital trust.

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