***SoulPass - Soulbound NFT Based Certification System***

**Project Synopsis**

Of Major Project

***Submitted to***

***G H Raisoni College of Engineering & Management Nagpur,***

***In partial fulfillment of the requirement for the award of degree of***

**Bachelor of Technology**

**In**

**Computer Science & Engineering (Cyber Security)**

*Submitted by*

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*Under the guidance of*

Prof. Shalini Kumari

(Guide)



**Department of Computer Science & Engineering (Cyber Security)**

**G H Raisoni College of Engineering & Management Nagpur**

(Formerly Known as G H Raisoni Institute of Engineering & Technology, Nagpur)

(Approved by AICTE, New Delhi and Recognized by DTE, Maharashtra)

An Autonomous Institute Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

**Accredited by NAAC with A+ Grade**

**Session: 2025-2026**

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We, the above-mentioned students of Final year Computer Science & Engineering (Cyber Security)Department, wish to undergo the projecttitled **‘Title of Project** under the guidance of **Prof.** **XYZ (Guide) and Prof.** **XYZ (Co-Guide)** for the **session 2025-26.**

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**Introduction**

The shift toward digital transformation in education has created a need for secure, verifiable, and tamper-proof credential systems. Traditional methods—whether paper-based or centralized—are prone to forgery, loss, and slow verification, and often lack interoperability, transparency, and lifetime accessibility.

**SoulPass** is a decentralized credential verification system that uses **Soul bound NFTs (SBTs)** to permanently bind credentials to an individual’s blockchain wallet. These non-transferable, immutable tokens ensure authenticity for achievements such as event participation, academic accomplishments, and institutional recognition. Metadata is stored via **IPFS**, making credentials publicly verifiable without reliance on centralized authorities.

The system enables event organizers and institutions to issue credentials seamlessly. Students can scan a **QR code** during events, triggering instant minting of a Soul bound NFT tied to their identity. This eliminates manual attendance tracking, prevents duplication, and builds a lifelong, verifiable academic portfolio. Institutions can verify credentials directly via blockchain or the SoulPass portal, improving trust and reducing administrative effort.

Incorporating principles from **rejectable soul bound tokens (RejSBTs)**, SoulPass supports **selective reception**, ensuring only rightful recipients can accept credentials. It aligns with **self-sovereign identity (SSI)** principles, empowering individuals to control their own verifiable achievements.

While initially focused on academic events, SoulPass can extend to **digital transcripts, online course completions, professional certifications, and job fair participation**, creating a scalable, secure, and transparent ecosystem for digital credential management.

**Literature Survey**

Existing research highlights multiple approaches to designing decentralized credential systems, with a focus on non-transferability, user control, interoperability, and trust.

1. **Digital Credentials Management System using Rejectable Soul bound Tokens (RejSBTs) — Rosa Pericàs-Gornals et al. (Springer, 2024)**

Enhances SBTs by allowing users to accept or reject credentials, implements non-repudiation, and manages privacy-aware metadata.

1. **Soul bound Token Framework for Privacy-Preserving Verification — Reddy & Kushwaha (ICDSAC, 2023)**

Proposes non-transferrable SBTs with selective disclosure and key recovery mechanisms for users.

1. **Web 3.0 and a Decentralized Approach to Education — Flanery et al. (arXiv, 2023)**

Implements DIDs and DID-based access control to attach credentials directly to users over a secure, decentralized Web3 ecosystem.

1. **Blockchain-Enabled Micro-Credentialing for Lifelong Learning — University of Ljubljana (EDULEARN25, 2025)**

Uses blockchain to enhance trust, mobility, and interoperability of micro-credentials in lifelong learning systems.

1. **ZKBAR-V: Zero-Knowledge Academic Record Verification System — Berrios Moya et al. (Sensors, 2025)**

Leverages zk-proofs, dual-blockchain architecture, DIDs, and IPFS to enable privacy-preserving credential verification without exposing user data.

1. **BACIP: Blockchain Academic Credential Interoperability Protocol — Berrios Moya (arXiv, 2024)**

Introduces a zero-knowledge and interoperability protocol to prevent academic fraud and support global credential verification.

1. **Cerberus: Blockchain-Based Degree Verification System — Tariq et al. (arXiv, 2019)**

Provides smart contract-based revocation, selective disclosure, and audit mechanisms for academic credentials.

1. **NFTCert: NFT-Based Certificates with Payment Integration — Zhao & Si (arXiv, 2022)**

A practical NFT-based certificate system featuring minting, verification, and a payment gateway—with an emphasis on usability.

1. **SBTCert: Soul bound Token Certificate Verification System — Tumati, Jiang & Tian (IEEE CCNC, 2024)**

Presents a non-transferable credential issuance system suitable for academic degree verification with on-chain validation.

Collectively, these studies illustrate a progressive movement toward **self-sovereign, blockchain-based credential systems** that prioritize **security, authenticity, privacy, and user control**. They establish a strong foundation for the development of **SoulPass**, which integrates RejSBT principles, lifelong academic record management, and user-centric verification processes to create a scalable, verifiable, and tamper-proof credentialing platform for educational institutions and beyond.

**Problem Statement**

Traditional and existing digital certificate systems used by event organizers and educational institutions suffer from inefficiencies, vulnerabilities, and a lack of standardization. Paper-based certificates are highly susceptible to loss, damage, and duplication, while many digital alternatives still depend on centralized databases that can be hacked, altered, or deleted. The absence of a globally accepted verification mechanism forces institutions to rely on slow, manual validation processes, creating bottlenecks in confirming authenticity. This lack of permanent ownership, transparency, and tamper-proofing erodes trust in issued credentials. Consequently, students are deprived of a secure, verifiable academic record, and administrators face difficulty in maintaining and verifying genuine credentials.

**Challenges:**

**🔹 For Admins:**

* **Risk of forgery and fraud:** Certificates can be replicated or manipulated without detection, leading to false claims of participation or achievement.
* **No secure verification mechanism:** Institutions must manually validate certificates, often by contacting the issuing authority, which is time-consuming, error-prone, and not scalable for large events or multiple verifications.

**🔹 For Students:**

* **Loss or damage of certificates:** Physical certificates can be misplaced, stolen, or destroyed over time, while some digital versions may become inaccessible due to server failures or expired storage links.
* **No authenticity proof:** Students lack an independent, verifiable proof of their achievements, making it difficult to present credentials confidently to employers, institutions, or professional bodies.

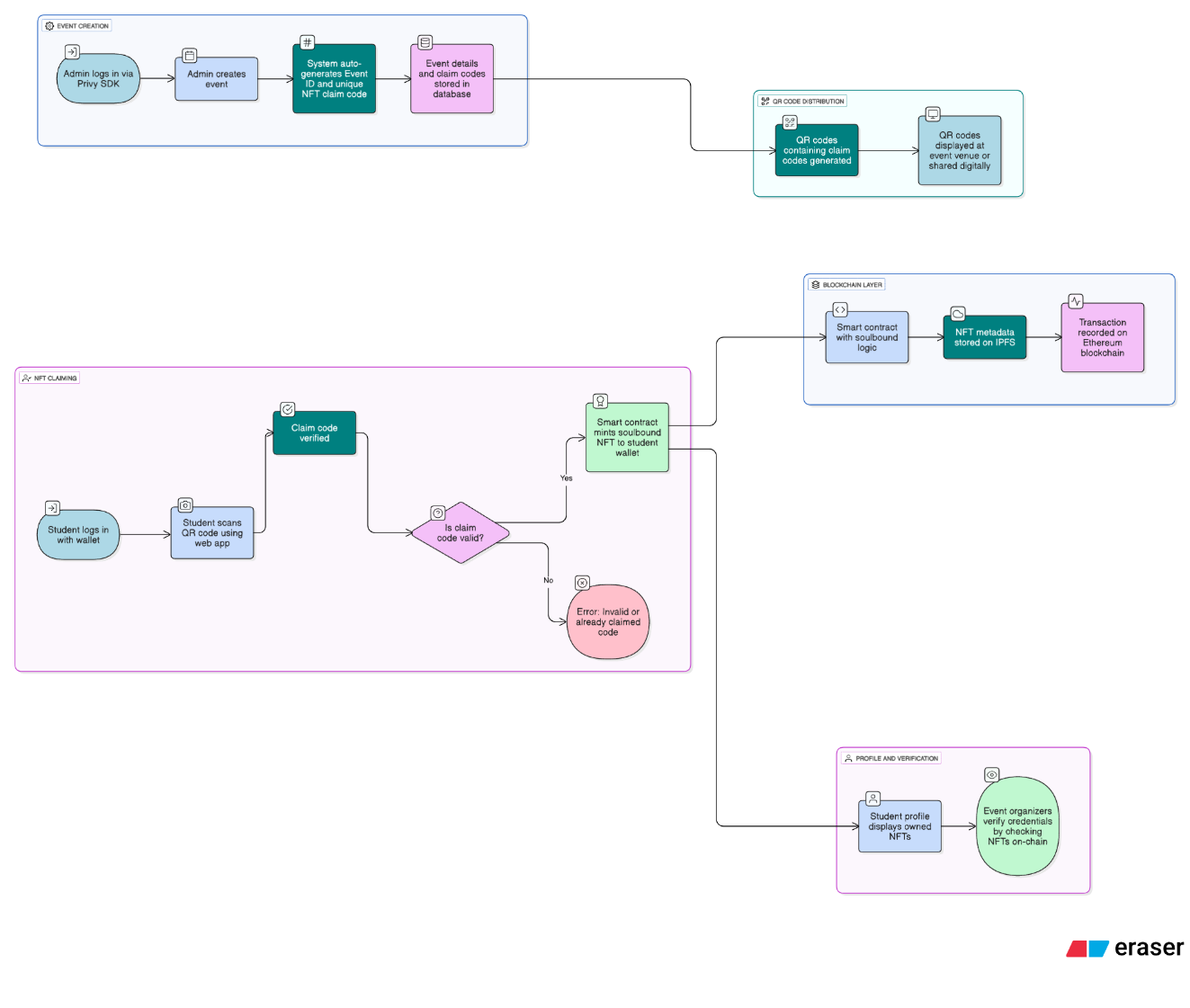
**Objectives of the Project**

The primary objective of the **SoulPass** project is to design and develop a secure, transparent, and tamper-proof **Attendance and Event Credential Verification System** using **Soul bound NFTs**. This system leverages blockchain technology to provide immutable proof of participation while offering a seamless, modern, and student-friendly user experience.

The specific objectives of the project are:

1. **Implement a Soul bound NFT Credential System**
   * To design and deploy **non-transferable ERC-721 tokens** (Soul bound NFTs) that represent unique attendance or event participation credentials.
   * Ensure that each credential is permanently bound to the student’s blockchain wallet, preventing resale or unauthorized transfer.
2. **Enable Secure and Instant NFT Claiming via QR Codes**
   * To develop a **QR code-based claim mechanism** where participants can instantly claim their event credentials by scanning a code during the event.
   * Integrate hybrid claiming modes (live scan and manual code entry) to cater to various real-world event scenarios.
3. **Provide a Transparent and Immutable Record of Participation**
   * To store attendance records on the blockchain, ensuring **tamper-proof verification** for academic and extracurricular activities.
   * Allow third parties, such as recruiters or institutions, to verify a participant’s credentials without relying on centralized databases.
4. **Design an Intuitive and Responsive Web Interface**
   * To build a **Next.js + Tailwind CSS** based frontend that is mobile-friendly, visually appealing, and simple for both administrators and students to use.
   * Include dedicated interfaces for event creation, NFT claiming, and profile views that display all owned credentials.
5. **Automate Event Credential Management for Organizers**
   * To enable administrators to create events that automatically generate unique claim codes and corresponding NFT metadata.
   * Reduce manual workload while ensuring a consistent and secure process for issuing participation credentials.
6. **Promote Adoption of Blockchain in Academic and Event Management**
   * To demonstrate the **practical use of blockchain technology** beyond cryptocurrency, fostering trust and transparency in academic and event environments.
   * Encourage institutions to adopt decentralized credential verification systems for improved record-keeping and recognition.

**Design / Block Diagram**

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**Work plan**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Months Activities** | **JUN’25** | **JULY’25** | **AUG’25** | **SEPT’25** | **OCT’25** |
| **Literature Reviews** | **√** | **√** |  |  |  |
| **Component Identification**  **& Selection** |  | **√** |  |  |  |
| **Designing** |  | **√** | **√** |  |  |
| **Fabrication** |  | **√** | **√** |  |  |
| **Experimental Analysis** |  | **√** | **√** | **√** |  |
| **Testing and debugging** |  | **√** | **√** | **√** |  |
| **Preparation of Project Report** |  |  | **√** | **√** |  |
| **Thesis and Poster Submission** |  |  |  |  | **√** |

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