



Bibaho-Bondhon

A BlockChain Based Transparent Marriage and Divorce
Registration System



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Executive Summary

This whitepaper proposes a blockchain based solution that revolutionizes marriage and divorce registration, ensuring transparency, efficiency and standardization while respecting cultural and legal diversity. Marriage is one of the most important decisions a person makes in their life and wants this process to be most secure and transparent. The current system for marriage and divorce registration suffers from a lack of transparency, inefficiency and legal complexities which leads to fraud, disputes and challenges in accessing rights. These issues are further aggravated in the context of multiple marriages, child marriages and subsequent divorces. As a result the trust level is quite unsatisfactory in the current system and even the general e-marriage system would be inadequate to solve all the problems and provide transparency and security properly. A blockchain system would be the perfect approach to eliminate all the problems such as complex legal processes, age verification, documentation, asset distribution, marital status verification etc. Our digital platform overcomes barriers of remote locations and limited documentation, enabling individuals to securely register their marriages and divorces. For subsequent marriages and divorces, our automated smart contracts simplify complex legal procedures, ensuring fair outcomes for asset distribution, child custody, and financial obligations. This whitepaper suggests a blockchain based solution architect of a framework named Bibaho-Bondhon to solve all the problems on the current marriage registration and divorce system

1.Introduction

The Bangladeshi government's a2i (Access to Information) project is working to create an e-governance ecosystem, including an upcoming online marriage and divorce registration system and database. This system is crucial as Bangladesh aims to become a 'Smart Bangladesh'. Once implemented, citizens will be able to easily access their official marriage and divorce records online, with the information validated by the government, without having to pay unnecessary fees or visit government offices.

The proposed framework suggests using a blockchain platform called Bibaho-Bondhon to store personal data related to marriage and divorce registration. Blockchain technology is being adopted by government agencies and companies due to its focus on security, data privacy, and trust. Bibaho-Bondhon's decentralized and secure platform simplifies the process, ensuring transparency and accountability. By creating an immutable record of transactions and NID (National ID) verification, it addresses challenges like child marriages, fraudulent marriages, and disputes.

When a client submits a marriage registration request, the system uses advanced encryption and access control to secure their data. The verified details are then recorded on the blockchain, ensuring a tamper-proof and verifiable marriage certificate. In the event of a divorce, Bibaho-Bondhon's automated smart contracts simplify the complex legal procedures, ensuring fair outcomes for asset distribution, child custody, and financial obligations. With verifiable marriage records, the divorce process becomes more efficient and just.

Overall, the proposed blockchain-based system aims to leverage the inherent security, transparency, and immutability of blockchain technology to address challenges in the current marriage and divorce registration process, while providing citizens with reliable and accessible vital records.

2. Background Study

2.1 Situation in Bangladesh

Bangladesh is prioritizing the digitalization of its marriage and divorce registration system to address challenges like child marriage and fraudulent registrations. While significant progress has been made in birth and death registration, marriage registration rates remain low, with the process still being paper-based.

In 2019, the country-wide marital status stood at around 61%, with the average marriage age being 25 for men and 18 for women. Despite mandatory registration for Muslims, the paper-based systems are inadequate, and the data is not usable for evidence-based policymaking.

The government recognizes marriage registration as crucial to achieving its target of eradicating child marriage by 2041. Increasing registration rates can help verify the age of couples and prevent underage marriages.

Plans are underway to develop an online marriage and divorce registration system that will integrate with the existing digital birth and death registration system, supporting age verification.

According to official reports, over 30 million people got married in Bangladesh last year, even during the COVID-19 pandemic. The pandemic exacerbated challenges like unemployment, poverty, and school closures, leading some families to marry off their daughters at a young age.

While official data is unavailable, a survey found that 79.5% of respondents who reported being married had registered their marriage, out of 99.1% who said they were married.

To strengthen the marriage registration system, key strategies include standardizing and digitizing the process, expanding the role of marriage registrars, and educating people on the importance of registration.

Bangladesh is also exploring the use of blockchain technology to manage marriage and divorce registration, aiming to leverage its immutability and transparency to create a secure, decentralized system that can reduce data tampering and fraud.

2.2 Situation in Other Countries

Based on some research, here is an overview of e-marriage systems in different parts of the world:

Asia

- India: India has an online marriage registration system called the National Population Register (NPR). Couples can apply for marriage registration through the NPR portal and make payments digitally.
- Singapore: Singapore has an e-marriage system where couples can apply for marriage licenses and register their marriages online.
- China: China has a centralized online marriage registration system where couples can apply and pay for marriage certificates electronically.

Europe

- Estonia: Estonia has a fully digital marriage registration system where couples can apply, pay, and receive their marriage certificates online.
- Italy: Italy has an e-marriage system where couples can submit marriage applications and documents digitally.
- Spain: Spain has an online marriage registration portal where couples can complete the entire process digitally.

America

- Canada: Some provinces in Canada, like Ontario, have online marriage license application systems.
- United States: The US does not have a nationwide e-marriage system, but some states like California and New York offer online marriage license applications.

Africa

- South Africa: South Africa has an online marriage registration system called the National Population Register.

Overall, the adoption of e-marriage systems is increasing globally, but the level of digitization and centralization varies significantly between countries. Countries like Estonia and China have more advanced nationwide e-marriage platforms, while others are still in the early stages of digitizing marriage registration processes.

3.Problem Study (Objective)

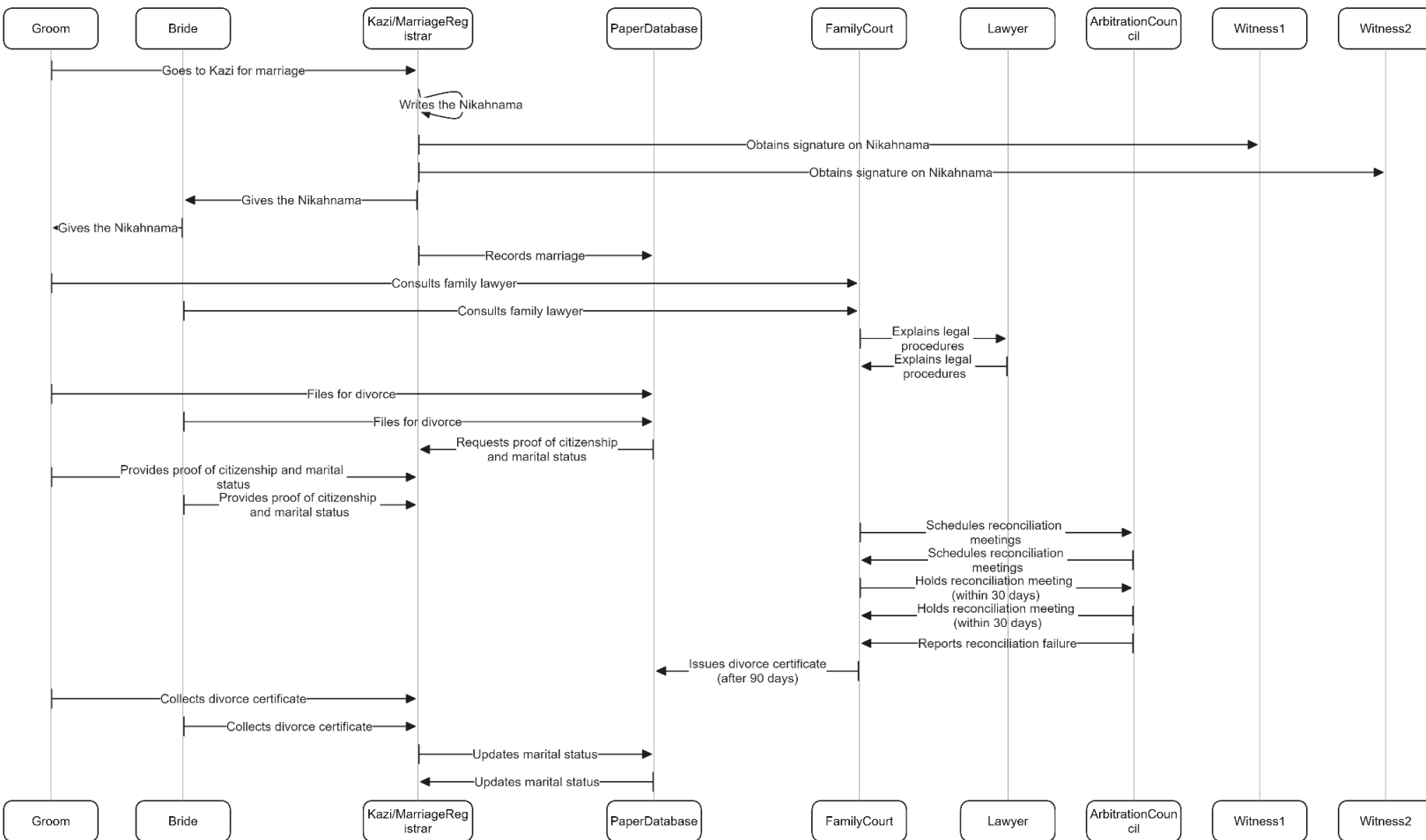


Fig: Current system

The current marriage registration process in Bangladesh involves physically signing paper documents, which are then submitted to the registrar's office. Due to significant delays in the registration process, other procedures related to marriage documents become highly vulnerable, contributing to issues such as fraudulent marriages, child marriages, unverifiable marital histories, and forged information in related documents.

The general process is as follows:

1. One party provides written notice to the registrar who will solemnize the marriage, from a district where at least one party has resided for 14 days.
2. Before solemnization, the parties and three witnesses sign a declaration in the registrar's presence. If either party is under 21, their father/guardian (except widows) must also sign, countersigned by the registrar.
3. The marriage is solemnized in the presence of the registrar and three witnesses, with each party saying to the other, "I [A], take the [B], to be my lawful wife (or husband)."

4. The registrar enters a certificate in the "Marriage Certificate Book" and has it signed by the parties and witnesses.
5. The registrar sends certified copies of entries to the Registrar General at prescribed intervals.

This paper-based process, with its inherent delays and complexities, highlights the need for a more efficient and secure marriage registration system in Bangladesh.

That was a general marriage process which is solely paper based and a lot complicated as well.

Now we'll discuss about a general divorce registration process-

- The First Step is pronouncing talaq. A husband who wishes to divorce may verbally pronounce Talaq to his wife.
- Soon after the pronouncement, a written notice to the chairman of union Parishad or any other authorized officer shall be given. Also, a copy of this notice shall be given to the wife.
- After that, the chairman shall constitute an arbitration council within 30 days of the notice attempting to reconcile between the parties and take all other necessary steps for reconciliation.
- If reconciliation fails then the divorce will become effective after the 'iddat' period, which is 3 months. These 3 months shall be completed for talaq to become effective. In case the Wife is pregnant at the time of Talaq, the divorce will only commence after the pregnancy.

Delving deeper into the current system, we can find the following problems which invoke us to propose a blockchain based digitized marriage registration system:

1. **Data Security and Privacy:**

Traditional marriage registration systems store data in a physical database. Aside from the system being highly susceptible to forges, it has zero security of information. Any unauthorized personnel can access the information about the candidates without the consent of the involved individuals. Even if the system were to be digitized depending on a centralized database, it will be vulnerable to data breaches and unauthorized access.

2. **Insecure Data management:**

There is no central database for the marriage and divorce registration procedure. The existing system for marriage registration uses physical databases during the whole process. For Muslim marriage registration, the registrar copy is physically transported to the government authorities responsible in the field. Apart from the whole process being extremely inconvenient, it also involves the risk of the database being completely destroyed.

3. **Divorce Proceedings:**

In cases of divorce, the distribution of assets and resolution of financial matters can be complex and time-consuming, often requiring multiple legal processes. The importance of accurate marriage data in such cases is of utmost importance. It is impossible to proceed with the divorce process and expect a fair outcome without an accurate marriage certificate. Currently, the existing system has no strong technology for evaluation through which one can identify a falsified marriage certificate. It is often the case that many couples get a marriage certificate during the divorce proceedings.

4. **Asset distribution:**

Both the divorce and asset distribution or inheritance proceedings are closely associated with the marriage registration paper. Whether it is during the divorce procedure, after the divorce or while being married, the conjugal life and status of a person is lawfully tied to his assets, investments and properties. Disputes often arise in the subject of asset distribution, inheritance and financial rights which cannot be handled fairly unless the data authenticity of a marriage contract is rightly maintained. With the current system preserving data on a physical notebook, it is impossible to ensure the authenticity of that data.

5. **Fraudulent marriage organization and registration:**

Over the past few years, there have been cases where couples have been duped into registering their marriages under fake Kazi offices. According to the Law Ministry, there are about 400 Kazi offices, currently functioning without any license or government validation. Marriages conducted by these offices will not be legally recognized. In the prevailing system, the general public has little to no idea about the authenticity of Kazi offices (Muslim marriage registration organizations) and the associated Kazies.

6. **Interoperability and Cross-Jurisdictional Validity:**

Given the vulnerability of the current system, marriage certificates issued in our national jurisdiction are not easily recognized or accepted in another. Additional certification is necessary to authenticate a person's marital status when someone intends to travel or migrate to another country. This lack of interoperability can create difficulties when couples move or travel internationally.

7. Dispute Resolution:

Disputes related to marriage, such as disagreements over the terms of marriage contracts or marital status, can be time-consuming and costly to resolve through traditional legal processes.

4.Design outline

4.1 General Description Proposed process (Methodology)

In the BibahoBondhon project, user registration starts with the bride and groom providing their information through a ReactJS frontend interface, which is then processed by a Node.js backend. For KYC verification, the backend interacts with Porichoy.gov.bd to verify identities using government-issued IDs and biometric data. Upon successful verification, the data is encrypted and uploaded to IPFS, with a generated hash stored on the Solana blockchain to ensure data immutability. On the marriage day, the registrar inputs the necessary information via the frontend, which is verified by both parties. The backend processes this data and records it on the Solana blockchain through smart contracts written in Solang. Users can request a copy of their marriage certificate, which the backend retrieves from IPFS and validates against the blockchain hash before providing. For divorce filings, either party can use the interface to file, with the backend processing and recording the data on the blockchain. Proofs of citizenship and marital status are verified, encrypted, and stored on IPFS, with their hashes recorded on Solana. Reconciliation meetings are scheduled and managed via the frontend, with outcomes recorded on the blockchain. If a divorce proceeds, a certificate is issued and stored on IPFS, with the hash recorded on Solana. The marital status of both parties is then updated via the frontend, processed by the backend, and recorded on the blockchain.

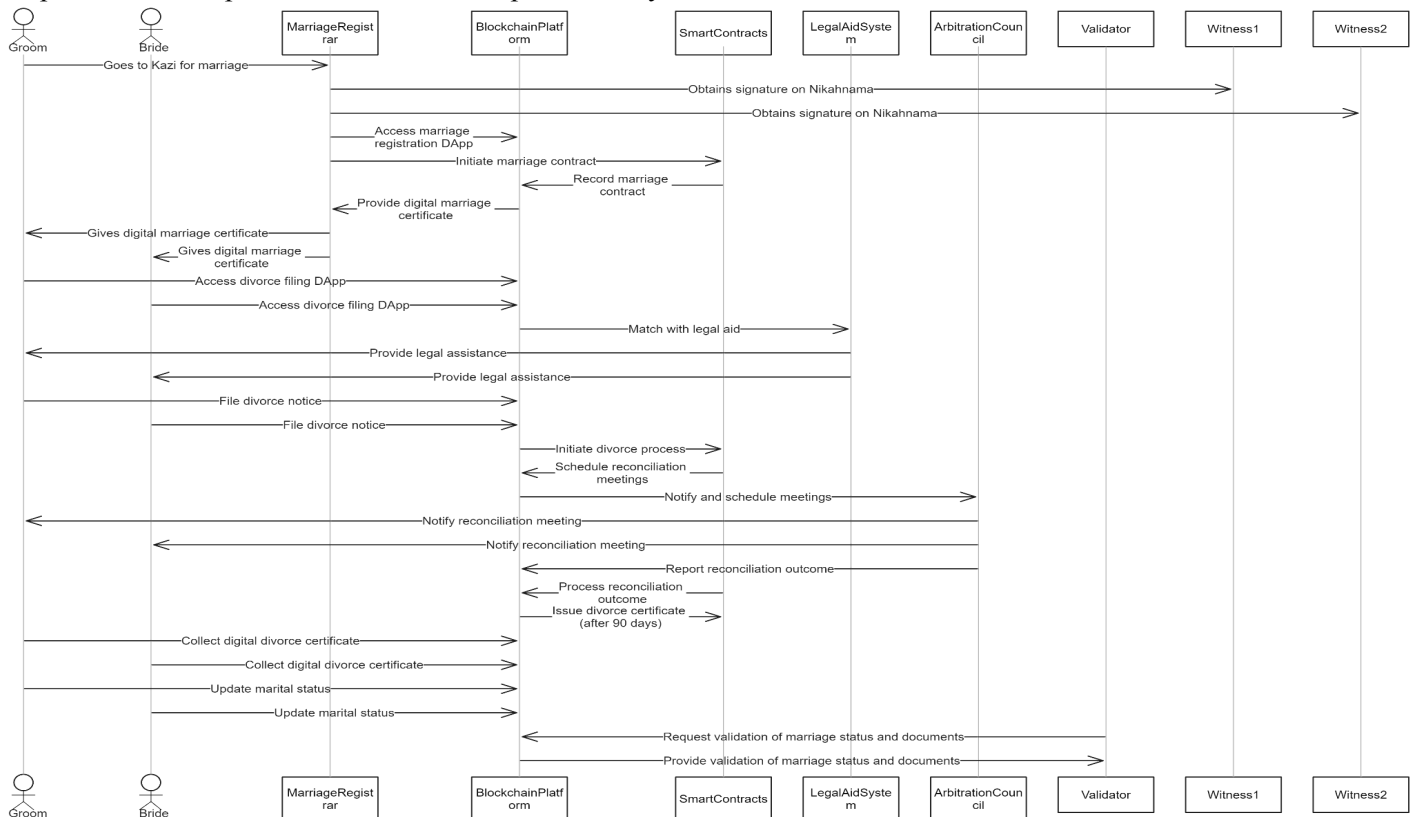


Fig: Proposed Process

4.2 How we provide a better solution

We aim to address the problems identified in the current marriage registration process in Bangladesh. By leveraging blockchain technology, we can provide solutions to these issues and improve the overall efficiency and security of the existing system. A brief discussion on how we are addressing the prevalent issues is given below:

1. Data Security and Privacy:

By implementing a blockchain-based system, we can ensure the security and privacy of individuals' data. Blockchain's decentralized and immutable nature eliminates the risk of data tampering and unauthorized access. Each marriage record will be securely stored on the blockchain, accessible only by authorized parties, ensuring the confidentiality and integrity of personal information.

2. Database Vulnerability:

With a blockchain-based system, the need for physical databases is eliminated. All marriage registration data will be securely stored on the distributed ledger, removing the risk of physical damage or loss. Even in the case of natural disasters or accidents, the data remains intact and can be easily accessed, providing a reliable and resilient solution.

3. Divorce Proceedings:

Our blockchain system will ensure the accuracy and authenticity of marriage certificates. When it comes to divorce proceedings, having a verifiable and tamper-proof marriage certificate is crucial. By storing marriage records on the blockchain, the system can accurately validate the marriage history, facilitating fair and efficient divorce proceedings.

4. Asset Distribution:

By maintaining an immutable record of marriage contracts, the authenticity and accuracy of marital status and financial terms and conditions on the marriage contract can be verified. This ensures a fair and transparent process for asset distribution, inheritance rights, and financial claims, minimizing disputes and ensuring a just outcome.

5. Fraudulent Marriage Organization and Registration:

Our blockchain system enhances trust and transparency in the marriage registration process. By storing marriage data on a decentralized and immutable ledger, individuals can easily verify the authenticity of Kazi offices and associated Kazies. This helps prevent fraudulent practices and protects couples from falling victim to fake Kazi offices, ensuring the legitimacy and integrity of the marriage registration process.

6. Interoperability and Cross-Jurisdictional Validity:

The blockchain system improves interoperability and cross-jurisdictional recognition of marriage certificates. By digitally storing and validating marriage records on the blockchain, certificates issued in our national jurisdiction can be easily recognized and accepted internationally. This eliminates the need for additional certification and simplifies the process for individuals who intend to travel or migrate to another country.

7. Prevention of child marriage:

While progress has been made, Bangladesh continues to have the highest rates of child marriage in South Asia. 51% of women who are currently aged 20-24 were married while they were still children. As a result, the country is home to 38 million child brides who were married before their 18th birthday, including 13 million who married before the age of 15. If child marriage can be prevented, a number of health, social and economic benefits will be realised including reduced maternal mortality and stunting, increased participation from girls in education, and long-term benefits for the economy, all aspects of achieving Sustainable Development Goal 5. It is now widely known that the legal ages for women and men to be married are 18 and 21 respectively and Marriage Registrars are not allowed to register the marriages of underage boys and girls. Despite this, cultural practices remain and unless marriage registration becomes mandatory in practice, the ability to identify and prevent child marriages through this mechanism, remains futile, while religious marriages continue to take place without registration.

Apart from the stated solutions, our system is designed to prevent unlawful child marriages by verifying identity of the individual clients. Having access to birth certificate/ NID database, any client under the lawful age of marriage will be denied registration. By creating a separate account for each client who goes through the marriage registration process, the necessary data of the users will be available for verification purposes. Anyone seeking user information can view the marital history, age and necessary information to prevent fraudulent marriages.

4.3 Stakeholders

Stakeholder	Team Members	Responsibility
Groom	Groom	<ul style="list-style-type: none"> • Initiate the marriage process • Receive and give the digital marriage certificate • File for divorce notice • Collect the digital divorce certificate
Bride	Bride	<ul style="list-style-type: none"> • Participate in the marriage process • Receive and give the digital marriage certificate • Access divorce filing DApp • File for divorce notice • Collect the digital divorce certificate
Marriage Registrar	Marriage Registrar	<ul style="list-style-type: none"> • Provide access to marriage registration DApp • Provide digital marriage certificate • Provide legal assistance for divorce filing • Update marital status after divorce
Legal Aid System	Legal Aid System	<ul style="list-style-type: none"> • Match with legal aid • Provide legal assistance for divorce filing
Arbitration Council	Arbitration Council	<ul style="list-style-type: none"> • Notify and schedule reconciliation meetings • Notify reconciliation meeting • Report reconciliation outcome
Validator	Validator	<ul style="list-style-type: none"> • Provide validation of marriage status and documents
Government Authorities	Ministry of Law, Ministry of Women and Children Affairs	<ul style="list-style-type: none"> • Ensure legal compliance • Oversee the implementation of the system • Address any legal disputes

5. Governance

Governance in Bibaho-Bondhon involves a set of agreed-upon rules and regulations that participants and rule setters must follow. The primary objective is to meet user requirements with available resources, ensuring efficiency, effectiveness, and long-term sustainability of the platform.

The Bibaho-Bondhon platform is designed as part of an e-government body, leveraging blockchain technology to provide a reliable and immutable record of marital statuses and related processes. Achieving adaptability and upgradability are crucial challenges in blockchain governance. The ability to evolve and upgrade is key for maintaining relevance and competitiveness.

To establish a well-functioning governance system, three disciplines of governance must be addressed:

5.1 Technology Infrastructure Governance

This discipline deals with decisions regarding IT infrastructure, resources, performance, security, cost structures, and associated risks. In Bibaho-Bondhon, a permissionless public blockchain is utilized

5.1.1 Distributed IT Structure:

Bibaho-Bondhon employs a permissionless public blockchain architecture on Solana, ensuring high performance and security. The backend, developed in Node.js, handles data processing and interacts with the Solana blockchain, ensuring data integrity and immutability. The platform uses validators of the solana chain to maintain the distributed nature of the database, using the PoH(Proof of History) consensus process to validate and record transactions.

5.1.2 Technology Assessment and Adoption:

The system adopts various technologies to ensure security, efficiency, and user experience. ReactJS is chosen for its robust ecosystem and responsive interfaces, while Node.js is selected for its performance in handling asynchronous backend operations. IPFS is adopted for decentralized, secure data storage, and the Solana blockchain is used for its high throughput and low latency, enabling quick transaction processing. Solang, a compiler for Solana smart contracts, is employed to implement the logic for recording and validating data on the blockchain. These technologies collectively meet the system's requirements for interoperability, scalability, and security.

5.1.3 On-Chain and Off-Chain Data Services:

The system differentiates between on-chain and off-chain data to optimize performance and security. On-chain, only the hashes of encrypted data stored on IPFS are recorded on the Solana blockchain, ensuring data immutability without exposing sensitive information. Off-chain, actual user data, certificates, and other documents are stored securely on IPFS. The backend handles KYC verification and other interactions off-chain, with results processed and encrypted before storage. This separation ensures efficient data handling while maintaining integrity and security through blockchain verification.

5.1.4 Risk Mitigation:

To mitigate risks, the system employs several strategies focused on data security, integrity, operational continuity, and compliance. Data encryption protects sensitive information stored on IPFS, while KYC verification ensures legitimate user interactions. Blockchain hashing and regular smart contract audits safeguard data integrity. Operational continuity is supported by the distributed nature of IPFS storage and a scalable backend. A dedicated governance body oversees system operations, ensuring quality assurance, risk management, and adherence to regulatory compliance. Regular assessments and updates further ensure system efficiency and security.

5.2 Business Network Governance

The marriage registration system follows a strong Business Network Governance setup that ensures smooth and lawful operations. This structure is guided by a business charter that lays out goals, roles, and responsibilities for everyone involved, including government bodies and technical teams. The focus is on handling data securely, openly, and efficiently. Common services management oversees tasks like user verification, data encryption, storage, and blockchain transactions, ensuring they all work together seamlessly and meet high standards of data security. The system commits to strict Service Level Agreements (SLAs) to ensure it performs well and is available when needed. Regular audits and adherence to data protection laws help the system stay compliant with regulations, ensuring it remains reliable and trustworthy for users.

5.2.1 Business Charter & Operations Structure

The marriage registration system operates under a business charter that outlines its mission, objectives, and operational structure. This charter defines the roles and responsibilities of various stakeholders, including government entities like the ministry of land, registry offices, and technical teams. The system is designed to ensure secure, transparent, and efficient handling of marriage-related data, with a clear operational structure that delineates tasks such as user registration, data encryption, KYC verification, blockchain interactions, and data storage. The charter emphasizes the importance of data integrity, user privacy, and compliance with legal requirements, guiding the system's overall governance and operational strategy.

5.2.2 Common Services Management

Common services management in the system involves the coordination and oversight of essential services such as user authentication, data encryption, storage, and retrieval, as well as blockchain transaction processing. These services are managed centrally to ensure consistency and reliability across all interactions. The backend (Node.js) facilitates secure communication between the frontend (ReactJS), storage (IPFS), and the Solana blockchain. The system also integrates with external services like Porichoy.gov.bd for KYC verification. This centralized management ensures that all components work seamlessly together, providing a smooth user experience and maintaining high standards of data security and integrity.

5.2.3 Business SLA and Regulatory Compliance

Ensuring regulatory compliance for the marriage registration system means meeting a range of legal rules designed to protect people's privacy, keep digital transactions safe, and make sure everything operates openly. This includes following strict laws like GDPR that require us to handle personal data securely—collecting it safely, processing it carefully, and storing it in a way that keeps it private. We also have to stick to rules about verifying digital identities, making sure we use strong procedures to check who people are using IDs and biometric data.

Plus, we need to follow regulations about blockchain and smart contracts. That means every transaction we record on the Solana blockchain has to be legal and safe. We also have to keep records of marriages and divorces safe and make sure they're easy to get to when needed.

Protecting consumers is really important too. That means being clear about how we handle data, making sure people know their rights about privacy, and giving them ways to see and control their personal info. And because different places have different rules about marriage, online payments, and keeping data safe, we have to watch those rules closely to make sure we're following all of them.

To make sure we stay within the rules, we're always checking the laws, doing regular checks, and updating our policies and ways of doing things. We work with legal experts to help us understand and follow the rules as they change. This way, we can keep the marriage registration system running smoothly and make sure people trust us with their information.

5.3 Network Membership Governance

This discipline defines the rules for effective networking, including the onboarding and offboarding of participants, regulatory oversight, permission structures, and network operations.

5.3.1 Member On- and Off-boarding:

- Only verified kazi or marriage registers of the country can join the network. Verification is done through porichoy.gov.bd
- Government entities are considered founding members, while citizens and service providers(eg kazi or marriage registers) can join as regular members.

- Government or marriage bureau can invite other verified individuals to join the network.
- Onboarding involves verifying identities and assigning appropriate roles and permissions.

5.3.2 Regulatory Oversight Provisioning:

- Regulatory bodies have the power to oversee network operations to ensure compliance with government laws and regulations.
- Regular audits and assessments will be conducted to maintain transparency and trust.

5.3.3 Permission Structure:

- Founding members (government entities) have both read and write permissions.
- Regular members (citizens) typically have read-only permissions, but can submit transactions for approval.
- Permissions are strictly controlled and periodically reviewed.

5.3.4 Network Operations:

- All communication within the network is conducted through secure, end-to-end encrypted channels.
- Data privacy and integrity are maintained at all times.

6. Technical Architecture

6.1 High Level architecture

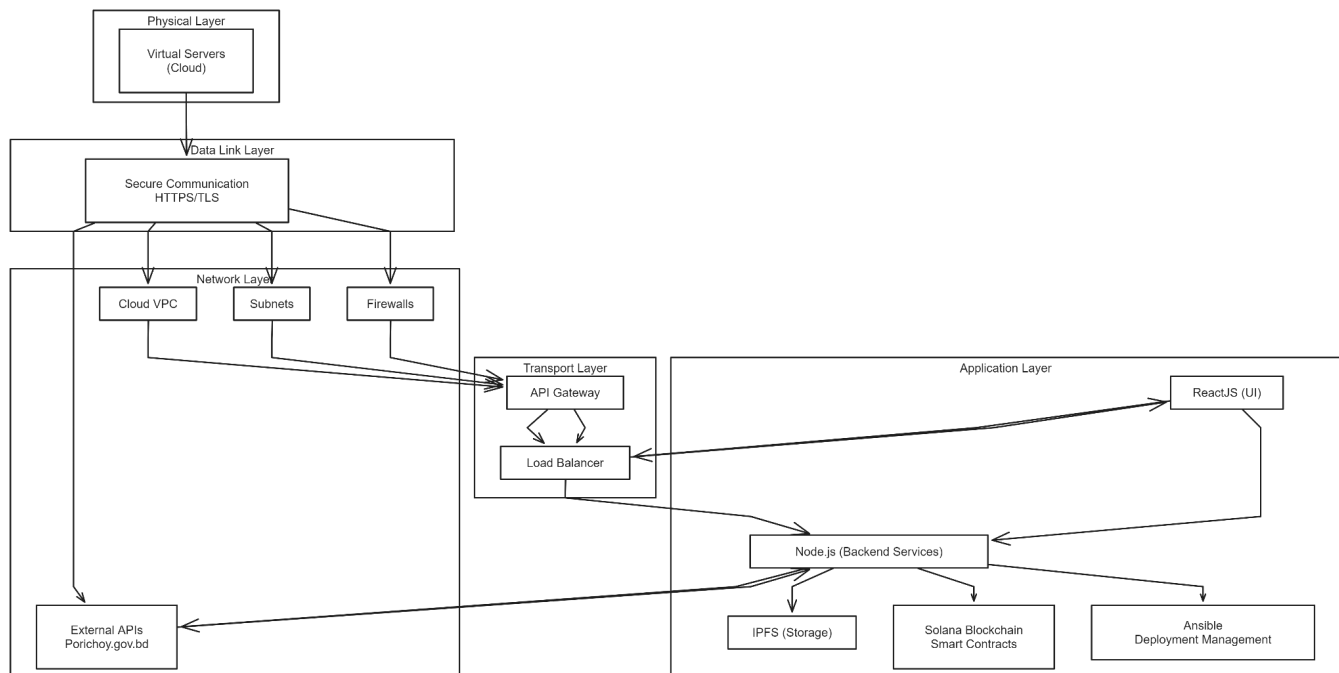


Fig: High Level architecture

The high-level architecture of your marriage registration system consists of several interconnected layers. The Physical Layer hosts virtual servers in the cloud, providing scalable and reliable infrastructure. The Data Link Layer ensures secure communication via HTTPS/TLS, protecting data integrity and privacy. The Network Layer includes components like Cloud VPC for isolated network environments, Subnets for network segmentation, Firewalls for security, and External APIs like Porichoy.gov.bd for identity verification. The Transport Layer features an API Gateway for routing requests and a Load Balancer for distributing traffic evenly across servers. The Application Layer incorporates a ReactJS UI for user interactions, Node.js for backend services, IPFS for decentralized storage, Solana Blockchain for smart contract execution, and Ansible for deployment management. Each component is crucial for providing a secure, efficient, and scalable system that ensures data integrity, user authentication, and seamless user experience.

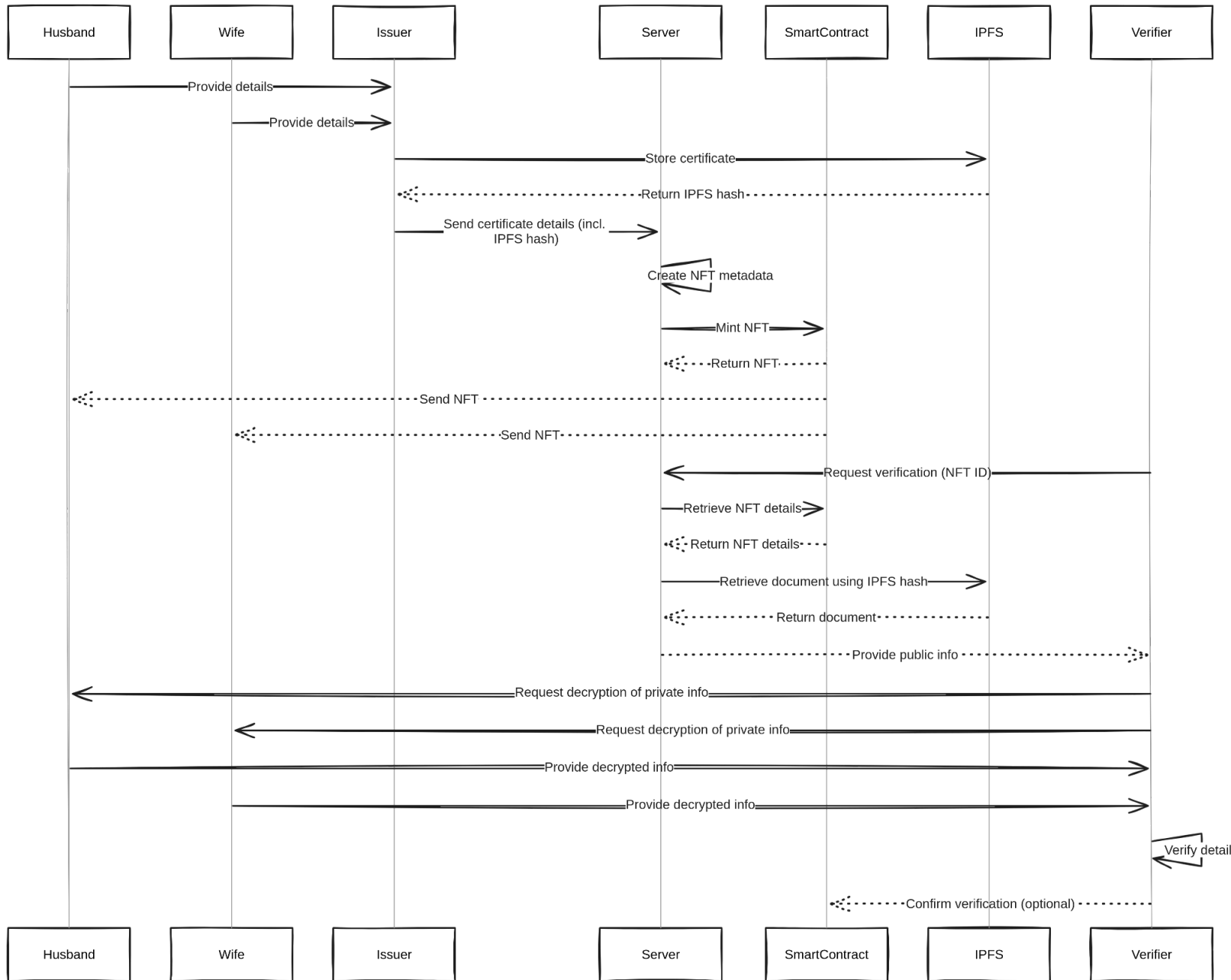


Fig: High level data flow

6.2 Read access control

Read access control matrix chart										
Entity:	Groom's name & ID	Bride's Name & ID	Government Authority's ID	Marriage Status	Marriage Register's NID	Grooms All Information	Bride's All Information	Marriage Fee	গণপত্র	Marriage Certificate Hash
Storage type:	On chain	On chain	On Chain	On chain	On chain	Off chain	Off chain	On chain	On chain	On chain
Stakeholder										
Groom	yes	yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	yes
Bride	yes	yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	yes
Marriage Register	yes	yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	yes
Legal Aid System	yes	yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	yes
Attribute Council	yes	yes	yes	Yes	Yes	yes	yes	Yes	Yes	yes
Validator	yes	yes	yes	No	Yes	Yes	Yes	Yes	Yes	yes
Government Authorities	yes	yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	yes
General Public	Only if Involved	Only if Involved	Only If Involved	only if involved	only if involved	only if involved	only if involved	only if involved	only if involved	only if involved

6.3 Write access control

Write access control matrix chart										
Column 1	Name & ID	Marriage Status	Government Authority's ID	Marriage Register's NID	Grooms All Information	Bride's All Information	Marriage Fee	গণপত্র	Marriage Certificate Hash	Divorce Certificate hash
On chain	On chain	On chain	On Chain	On chain	Off chain	Off chain	On chain	On chain	On chain	On chain
Stakeholder										
Groom	No	No	no	No	No	No	No	No	No	No
Bride	No	No	no	No	No	No	No	No	No	No
Marriage Register	Yes	Yes	no	Yes	Yes	Yes	Yes	Yes	Yes	No
Legal Aid System	No	No	no	No	No	No	No	No	No	No
Attribute Council	No	No	no	No	No	No	No	No	No	No
Validator	No	No	no	No	No	No	No	No	No	No
Government Authorities	Yes	Yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
General Public	yes	no	Only If Involved	no	no	no	no	no	No	no
Verifier	No	No	no	No	No	No	No	No	No	No

6.4 Low Level architecture

The system functions as a streamlined and secure platform for managing marriage registrations. It begins with the bride and groom entering their information through a user-friendly interface built with ReactJS. This data is sent to a Node.js backend, where it undergoes rigorous verification against government databases via Porichoy.gov.bd, ensuring authenticity through biometric checks and ID validation. Once validated, the information is encrypted and stored in a decentralized manner on the InterPlanetary File System (IPFS), which generates a unique hash. This hash is then recorded on the Solana blockchain through smart contracts, guaranteeing data integrity and immutability. Users can later request marriage certificates, with the system retrieving and validating the data from IPFS using the blockchain-stored hash, ensuring that all interactions remain secure and verifiable. This bidirectional flow of data between components provides a transparent and efficient solution for marriage registration and certificate issuance.

The Kazi (marriage registrar) will first sign the EIP-712 structured data. This data will include information about the marriage certificate, such as the names, NIDs, date of marriage, and the IPFS hash of the certificate document. The signing ensures that the data is authenticated and tamper-proof. Create and Store the Certificate on IPFS. Once the EIP-712 data is signed, the complete marriage certificate is created. This certificate includes all detailed information and Kazi's signature. The certificate is then stored on IPFS. IPFS will generate a unique hash (CID) for this document. Store the IPFS Hash in the NFT Metadata

The generated IPFS hash is included in the NFT metadata, along with the couple's image IPFS hash and other essential information. This metadata is then stored on the blockchain as an NFT, ensuring the integrity and accessibility of the marriage certificate information.

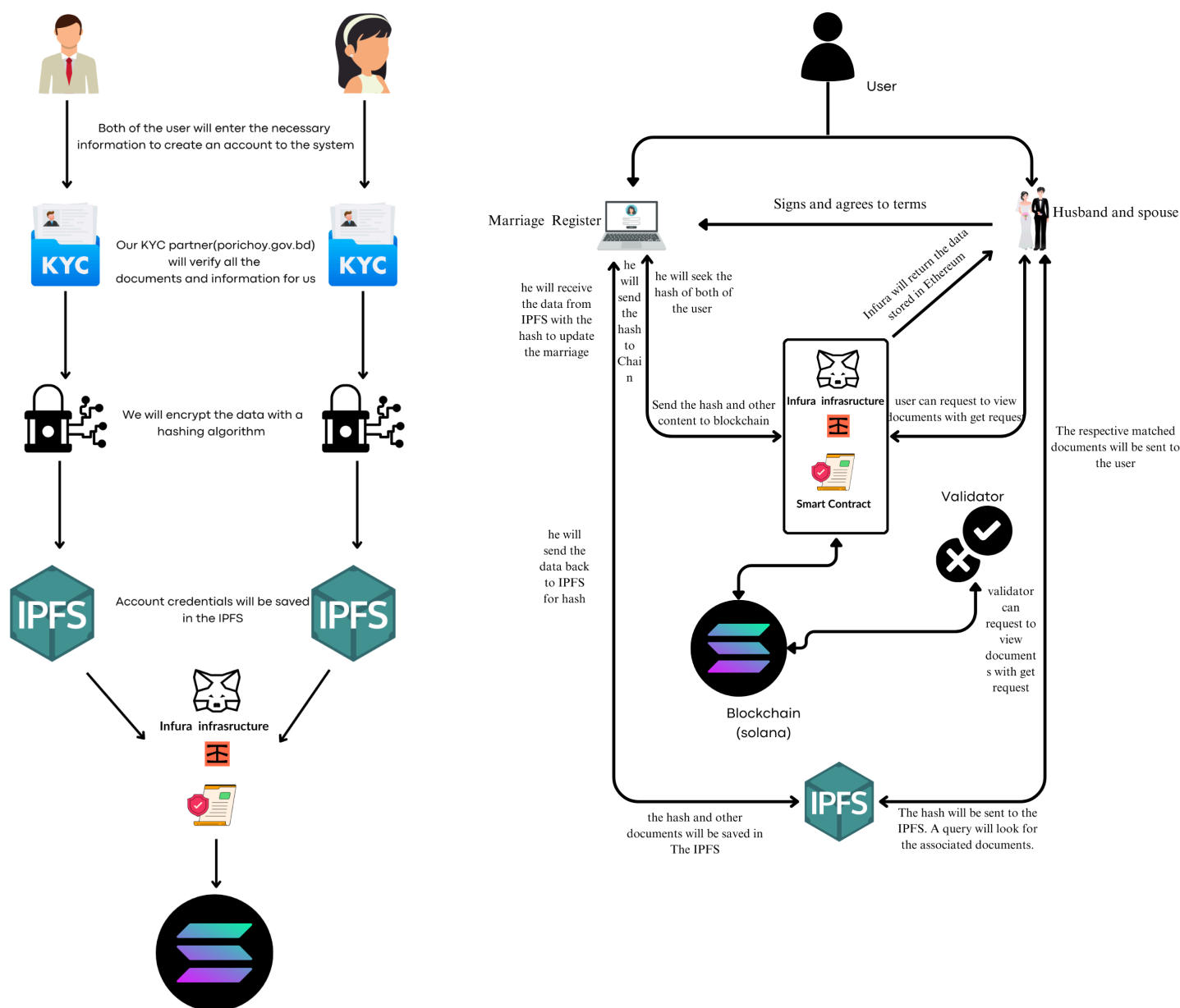


Fig: Low Level architecture

6.5 Consensus Protocol

For our marriage registration system, using Solana's Proof of History (PoH) combined with Proof of Stake (PoS) brings significant advantages. Proof of History works by creating a historical record that proves events have occurred in a specific sequence, which helps to quickly and efficiently validate transactions. This means our system can handle thousands of transactions per second with very low latency, ensuring users experience fast and responsive service when registering marriages or requesting documents.

Proof of Stake adds another layer of security and efficiency. In PoS, validators are chosen to add new transactions to the blockchain based on the amount of cryptocurrency they hold and are willing to "stake" as collateral. This reduces energy consumption compared to traditional Proof of Work systems, making it more environmentally friendly. Validators are financially motivated to act honestly, as they can lose their staked tokens if they attempt any fraudulent activity.

Combining PoH and PoS in your system means we benefit from high speed, scalability, and strong security.

Transactions are processed quickly and reliably, making the management of marriage records seamless and robust. This ensures transparency and trust, as all records are verifiable and tamper-proof, providing a secure and efficient solution for marriage registration.

6.6 Data Structure

```
{
  "domain": {
    "name": "BibahoBondhon",
    "version": "1.0",
    "chainId": 1,
    "verifyingContract": "0xYourContractAddress"
  },
  "types": {
    "EIP712Domain": [
      { "name": "name", "type": "string" },
      { "name": "version", "type": "string" },
      { "name": "chainId", "type": "uint256" },
      { "name": "verifyingContract", "type": "address" }
    ],
    "MarriageCertificate": [
      { "name": "husbandName", "type": "string" },
      { "name": "wifeName", "type": "string" },
      { "name": "husbandNID", "type": "string" },
      { "name": "wifeNID", "type": "string" },
      { "name": "ipfsHash", "type": "string" },
      { "name": "dateOfMarriage", "type": "string" },
      { "name": "kaziAddress", "type": "address" }
    ]
  },
  "primaryType": "MarriageCertificate",
  "message": {
    "husbandName": "Shahal",
    "wifeName": "Anika",
    "husbandNID": "1234567890123",
    "wifeNID": "9876543210987",
    "ipfsHash": "QmYourIPFSHash",
    "dateOfMarriage": "2024-07-01",
    "kaziAddress": "0xKaziAddress"
  }
}
```

Fig: EIP 712 in json format

```
{
  "name": "Marriage Certificate",
  "description": "Blockchain-based marriage certificate",
  "image": "ipfs://QmYourImageIPFSHash",
  "attributes": [
    {
      "trait_type": "Husband Name",
      "value": "Shahal"
    },
    {
      "trait_type": "Wife Name",
      "value": "Anika"
    },
    {
      "trait_type": "Husband NID",
      "value": "1234567890123"
    },
    {
      "trait_type": "Wife NID",
      "value": "9876543210987"
    },
    {
      "trait_type": "Date of Marriage",
      "value": "2024-07-01"
    },
    {
      "trait_type": "IPFS Document Hash",
      "value": "QmYourIPFSHash"
    },
    {
      "trait_type": "Kazi Address",
      "value": "0xKaziAddress"
    }
  ]
}
```

Fig: data to be stored in Blockchain in (json format)

```
{
  "certificate": {
    "husbandName": "Shahal",
    "wifeName": "Anika",
    "husbandNID": "1234567890123",
    "wifeNID": "9876543210987",
    "dateOfMarriage": "2024-07-01",
    "kaziAddress": "0xKaziAddress",
    "registerNumber": "1234",
    "pageNumber": "12",
    "volumeNumber": "34",
    "issuedBy": "Muslim Marriage Registrar & Kazi Office",
    "district": "Dhaka",
    "subDistrict": "Dhanmondi",
    "signatures": {
      "kaziSignature": "0xSignatureFromKazi"
    }
  },
  "signedData": {
    "domain": {
      "name": "BibahoBondhon",
      "version": "1.0",
      "chainId": 1,
      "verifyingContract": "0xYourContractAddress"
    },
    "types": {
      "EIP712Domain": [
        { "name": "name", "type": "string" },
        { "name": "version", "type": "string" },
        { "name": "chainId", "type": "uint256" },
        { "name": "verifyingContract", "type": "address" }
      ],
      "MarriageCertificate": [
        { "name": "husbandName", "type": "string" },
        { "name": "wifeName", "type": "string" },
        { "name": "husbandNID", "type": "string" },
        { "name": "wifeNID", "type": "string" },
        { "name": "ipfsHash", "type": "string" },
        { "name": "dateOfMarriage", "type": "string" },
        { "name": "kaziAddress", "type": "address" }
      ]
    },
    "primaryType": "MarriageCertificate",
    "message": {
      "husbandName": "John Doe",
      "wifeName": "Jane Smith",
      "husbandNID": "1234567890123",
      "wifeNID": "9876543210987",
      "ipfsHash": "QmYourIPFSHash",
      "dateOfMarriage": "2024-07-01",
      "kaziAddress": "0xKaziAddress"
    }
  }
}
```

Fig:NFT metadata

7.Valuation, Market & Partner

7.1 Value Proposition

Our project aims to contribute to achieving Sustainable Development Goals, particularly Goal 16 - Peace, Justice, and Strong Institutions, by leveraging blockchain technology to ensure transparency and trust in marriage and divorce registration. By digitalizing the registration process, we maintain accurate records, prevent fraudulent marriages, and ensure fair distribution of assets and custody arrangements, thereby promoting fairness in the institution of marriage.

Additionally, our initiative addresses inequalities by providing accessibility and inclusion in marriage and divorce registration, supporting SDG 5 and SDG 10. Furthermore, by promoting mental well-being and reducing stress related to marriage and divorce processes, we indirectly support Goal 3. Moreover, our efforts to decrease child marriage contribute to preventing stillbirths and promoting good maternity health.



Social value:

Reducing child and early marriage: Reducing child marriage is a global priority. Many countries have implemented legislation setting a minimum age for marriage to prevent the harmful practice of marrying children. Bibaho-Bondhon ensures to enforce the laws, provide access to quality education and economic empowerment.

Increasing transparency: Bibaho-Bondhon emphasizes transparency and accountability in all governance activities. This transparency will allow stakeholders to verify the legitimacy and integrity of the system's operations.

Eliminating fraudulent and middleman: Bibaho-Bondhon emphasizes on zero bribery, fraudulent and middleman and making the system decentralized. If there are any intermediates, they will be trained, licensed and managed by the government.

7.2 Revenue Streams

Points scored

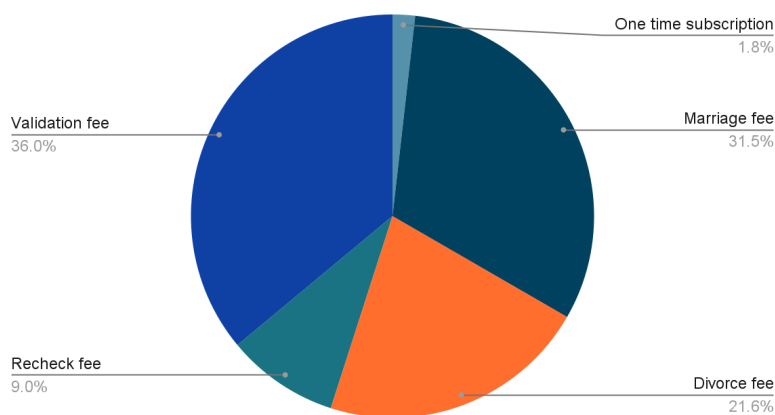


Fig: Revenue mode

Revenue Streams	Source Customer	Price (tk)	Overall contribution
One time subscription fee	Bride and groom both separately	100	300,000,000
Marriage fee	Bride and groom	1750 (base)	5,250,000,000
Divorce fee	Bride and groom	1,200 (base)	376,800,000
Update info fee	Bride and groom	375 per information	100,000,000
Validation fee	Various institutions	2000	200,000,000

7.3 Market size

Our estimated market comprises all the people getting married each year in Bangladesh. A population of **3 million** people will be actively seeking our services for marriage registration, every year. Adding on to that, the **7900** marriage register will function as verified registrars in our application with their individual accounts. Apart from that, we will have juries, legal professionals and matchmakers reaching out to us for verifying information.

One divorce in every 40 minutes alone in Dhaka.

The current registration fee for each marriage is a minimum of BDT 1250. With 3 million marriages being registered each year, the yearly revenue generated will be approximately **BDT 3.75 billions** 314,000 divorce with 1000 taka fee brings **31.44 crore taka**.

Adjusting the transaction gas fee, the new cost structure would bring **5.25 billion taka** annually for marriage alone. For divorce **37 crore taka**.

7.5 Key partners

- **Marriage Register Office :** To launch our project successfully, the first and foremost support will be sought from the existing Marriage Register offices. Currently 7900 marriage registers are working as verified registers in our current registration process. By partnering with them ,the system can integrate with existing infrastructure and processes, enhancing the efficiency and security of their operations.
- **Legal and Notary Services:** Marriage licenses must be validated and certified by law companies and notary services. We can perform NID verification and marriages that have already occurred, as well as provide a trustworthy and secure platform for digital marriage registrations and certificate verification, by working with platforms like porichoy.gov.bd/ and Bangladesh Forms and Publications Office.
- **Financial Institutions:** Financial institutions often require proof of marriage for various financial transactions, such as joint accounts, loans, or insurance policies. By partnering with banks and other financial service providers, the system can offer instant verification of marriage certificates, facilitating seamless and secure transactions for customers.
- **Insurance Companies and Healthcare Providers:** Insurance companies and healthcare providers often require proof of marriage for coverage purposes. By integrating with these entities, the system can provide authenticated and verifiable marriage records, reducing the risk of fraudulent claims and ensuring accurate coverage for policyholders.

8.Vision And Roadmap, Bangladesh and beyond.

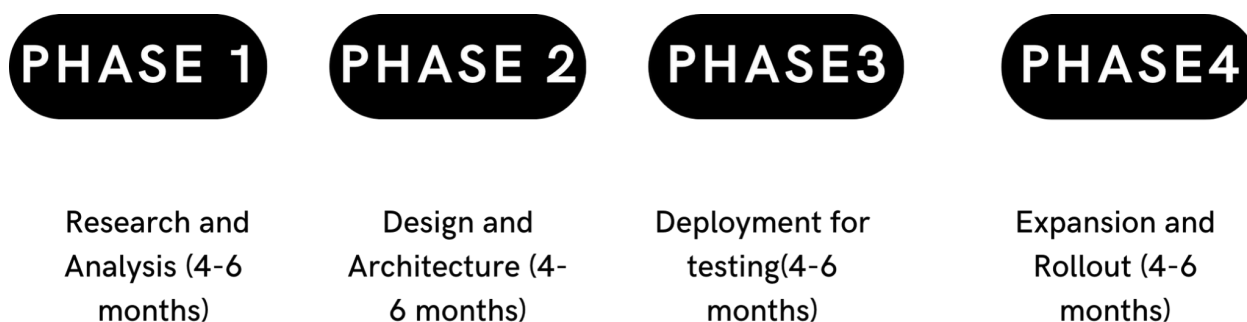


Fig: Road map

8.1 RoadMap

- **Phase 1:** Pilot Implementation in Bangladesh

Select Districts: Launch in targeted regions to test and refine the system.

Public Awareness: Educate citizens on the benefits of digital marriage registration through campaigns and partnerships with local NGOs.

Government Collaboration: Integrate with existing systems like Porichoy.gov.bd for identity verification and ensure legal compliance.

- **Phase 2:** Nationwide Rollout

Expansion to All Districts: Scale the system across Bangladesh based on pilot feedback.

Continuous User Support: Establish help centers and online support to assist users and registrars.

Integration with Additional Government Services: Collaborate with other governmental departments for seamless interoperability.

- **Phase 3:** Inclusion of Additional Civil Registrations

Birth and Death Certificates: Extend capabilities to manage other civil records, providing a comprehensive digital civil registration platform.

Training Programs: Conduct workshops for local registrars to ensure smooth adoption and use of the expanded system.

- **Phase 4:** Enhancement and Optimization

User Experience Improvements: Based on user feedback, continually enhance the interface and experience.

Security Upgrades: Implement advanced security measures to protect user data.

Mobile Accessibility: Develop mobile solutions for wider accessibility, especially in rural areas.

9.Risks, mitigation and Competitions

9.1 Risk

Along with many advantages, we also have some risks in this system

1. **Resistance to Change:** stakeholders, including government authorities, marriage registrars, and general people may be hesitant to embrace the new technology.
2. **Technological Vulnerabilities:** There can be data validation or error risk in the automated legal system.
3. **Connecting with Other Systems:** Making Bibaho-Bondhon work with other systems used by governments or legal offices could be tricky. It's important to make sure all systems can share information smoothly.

Mitigation

1. Making sure of transparency while digitizing the data
2. Proper training to the marriage registers and officials
3. Ensuring all the systems can share information simultaneously
4. Licensing and dedicating roles to the officials

9.2 Competitors

There are no other direct competitors working to digitize the marriage registration system, in our country. The existing e-services in the field of matrimony are all based on match-making, which are very similar to dating applications. In that context, we don't have any direct competitors in the market

10. Financial Model

10.1 Revenue Assumptions

Revenue Stream	Customer	Price (BDT)	Description
One-time subscription	Bride and Groom separately	100	Initial fee for subscribing to the digital marriage registration service.
Marriage fee	Bride and Groom	1,750	Fee for registering the marriage, including all necessary documentation and certification.
Divorce fee	Bride and Groom	1,200	Fee for processing and documenting a divorce.
Update info fee	Bride and Groom	500	Fee for updating personal information related to the marriage registration.
Validation fee	Various institutions	2,000	Fee for validating marriage certificates for use by third parties, such as financial institutions.

10.2 Market Size Assumptions

Description	Quantity	Details
Marriages registered per year	3,000,000	Total number of marriages expected to be registered annually in Bangladesh.
Divorces processed per year	314,000	Estimated number of divorces to be processed annually.
Marriage registrars participating	7,900	Number of marriage registrars to be onboarded as verified registrars in the application.

10.3 Revenue Projections

Revenue Stream	Annual Volume	Price (BDT)	Total Revenue (BDT)
One-time subscription	3,000,000	100	300,000,000
Marriage fee	3,000,000	1,750	5,250,000,000
Divorce fee	314,000	1,200	376,800,000
Update info fee	200,000	500	100,000,000
Validation fee	100,000	2,000	200,000,000
Total Annual Revenue	-	-	6,226,800,000

10.4 Expense Assumptions

Expense Category	Details	Annual Cost (BDT)
Operational Costs	Staff salaries, office rent, utilities, etc.	500,000,000
Marketing and Promotion	Campaigns, advertisements, public awareness programs	100,000,000
Technology Infrastructure	Servers, hosting, maintenance, software development	300,000,000
Training Programs	Training for marriage registrars and support staff	50,000,000
Legal and Compliance	Ensuring all legal and regulatory requirements are met	50,000,000
Miscellaneous	Other unforeseen expenses	50,000,000
Total Annual Expenses	-	1,050,000,000

10.5 Profit and Loss Statement

Description	Annual Amount (BDT)
Total Revenue	6,226,800,000
Total Expenses	1,050,000,000
Net Profit	5,176,800,000

10.6 Cash Flow and Investment Summary

Description	Amount (BDT)
Initial Investment Required	500,000,000
Expected Annual Cash Flow	5,176,800,000

Reference:

- https://data.unicef.org/wp-content/uploads/2023/05/Is_an_End_to_Child_Marriage_Within_Reach-3.pdf#:~:text=URL%3A%20https%3A%2F%2Fdata.unicef.org%2Fwp
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