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# FAMILY MEMORIES – CLOUD-BASED PHOTO &VIDEO SHARING SYSTEM

**Pawankumar Manjappa A[1], K Sharath[2]**

Department of MCA, BIT, K.R. Road, V.V. Pura, Bangalore, India[1]

Assistant Professor, Department of MCA, BIT, K.R. Road, V.V. Pura, Bangalore, India[2]

**Abstract:** The rapid digitization of photography has led to a fragmentation of family memories across disparate platforms, ranging from instant messaging apps that degrade quality to public social media networks that compromise privacy. Traditional cloud storage solutions, while secure, often present significant technical barriers for non-digital natives within a family unit. This paper presents the **Family Gallery Management System**, a secure, full-stack web application designed to centralize family media archives. The proposed system utilizes the MERN stack (MongoDB, Express.js, React.js, Node.js) to create a private social network governed by strict Role-Based Access Control (RBAC). A unique algorithmic approach to storage management enforces a strict 3GB resource limit per gallery, simulating enterprise resource constraints. Furthermore, the system introduces a password-less authentication mechanism based on phone numbers to ensure cross-generational accessibility. Experimental validation demonstrates that this architecture successfully balances the security of private cloud storage with the ease of use required for family social interaction, providing a robust solution for digital heritage preservation

**Keywords:** Web Development, MERN Stack, Role-Based Access Control, Cloud Storage, Family Social Network, Digital Archiving.

## I. INTRODUCTION

The preservation of family history has undergone a paradigm shift from physical photo albums to digital repositories. However, this transition has introduced new challenges regarding data privacy, accessibility, and organization.

As the volume of digital assets grows, families struggle to organize memories. Popular solutions like WhatsApp aggressively compress media, rendering it unsuitable for archival purposes. Conversely, professional cloud solutions like Google Drive or Dropbox often lack the narrative context of "Events" and require complex authentication processes (email/password/2FA) that alienate elderly family members. Furthermore, public social media platforms expose private moments to data harvesting algorithms, raising significant privacy concerns.

To address these limitations, there is a need for a specialized platform that combines the privacy of a hard drive with the accessibility of a web app.

### 1.1 Project Description

This paper describes the development of a **Family Gallery Management System**, a web-based application designed for the private curation of family memories. The primary objective is to create a "Walled Garden" where a designated Administrator manages the gallery infrastructure, while family members interact through a simplified interface. Unlike generic storage, the system leverages a hierarchical data model (Gallery -> Event -> Media) to maintain narrative context. The application integrates a React.js frontend with a Node.js backend, using MongoDB for metadata and Cloudinary for optimized media delivery.

### 1.2 Motivation

The motivation for this research stems from the "Digital Divide" within multi-generational families. While younger members are adept at navigating complex interfaces, older members often feel excluded from digital sharing due to technical friction. Additionally, the increasing cost of cloud storage necessitates intelligent resource management. This project aims to bridge these gaps by developing a system that is technically robust yet operationally simple, featuring a custom storage enforcement logic that teaches the principles of resource optimization in software development.

## II. RELATED WORK

Paper [1] investigates the paradigm shift from physical photo albums to digital repositories and the associated challenges in data privacy. The authors highlight that while digital storage offers convenience, it often fragments family history

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across disparate platforms. The study emphasizes the need for centralized, private digital archives that maintain the narrative context of "albums" rather than unstructured file streams, a concept central to the proposed Family Gallery system.

Paper [2] analyzes the limitations of Instant Messaging (IM) platforms like WhatsApp for long-term media archiving. The study demonstrates that aggressive lossy compression algorithms used by these platforms significantly degrade image quality, reducing a standard 4MB photograph to under 100KB. The authors argue that while IM is suitable for ephemeral communication, it fails as a reliable tool for preserving high-resolution family heritage, necessitating a dedicated solution with lossless or optimized storage capabilities.

Paper [3] explores the privacy implications of sharing personal data on public social networking sites (SNS) such as Facebook and Instagram. The authors discuss the risks of "Sharenting" (sharing photos of children online) and the subsequent exposure to data harvesting and targeted advertising. The paper proposes that private, "walled-garden" social networks with strict Role-Based Access Control (RBAC) are the only viable solution for ensuring absolute privacy for family-centric content.

Paper [4] presents a comparative analysis of monolithic versus microservices architectures for web applications. By evaluating the **MERN stack** (MongoDB, Express, React, Node.js), the study demonstrates its superiority in handling concurrent I/O operations, such as simultaneous file uploads. The authors conclude that the non-blocking nature of Node.js, combined with the flexible schema of MongoDB, makes the MERN stack an ideal choice for developing scalable media management applications.

Paper [5] addresses the "Digital Divide" affecting elderly users in accessing cloud storage services. The study identifies complex authentication methods (email, complex passwords, and two-factor authentication) as the primary barrier to adoption for non-technical seniors. The authors propose simplified authentication mechanisms, such as phone-number-based login or biometric access, to democratize access to digital resources across generations—a key feature implemented in this project.

Paper [6] investigates the efficacy of cloud-based Content Delivery Networks (CDNs) for media optimization. The authors evaluate services like Cloudinary and AWS S3, concluding that offloading media processing (resizing, format conversion) to a specialized CDN significantly reduces the computational load on the primary application server. This finding supports the architectural decision to integrate Cloudinary for handling the 3GB storage limit and image delivery in the proposed system.

## III. METHODOLOGY

### A. System Architecture and Data Environment

The proposed Family Gallery Management System is architected using a robust Three-Tier Model built upon the MERN stack (MongoDB, Express.js, React.js, Node.js). The client-side presentation layer is developed using React.js 18, employing a component-based structure to ensure a responsive and dynamic user interface across devices. The application logic resides in the server tier, powered by a Node.js runtime environment and the Express.js framework, which handles RESTful API requests. The data layer is bifurcated to optimize performance: MongoDB Atlas is utilized as a NoSQL database for storing unstructured metadata (user profiles, gallery hierarchy, event logs), while Cloudinary serves as a specialized Content Delivery Network (CDN) for hosting binary media files. This separation ensures that the application server remains lightweight and efficient.

### B. Role-Based Access Control and Authentication Strategy

A critical methodological component is the implementation of a distinct Role-Based Access Control (RBAC) system. The framework distinguishes between two primary actors: the Administrator and the Family Member. Administrators authenticate via a traditional secure flow, where passwords are salted and hashed using the Bcrypt algorithm before storage. Conversely, to address the "Digital Divide," Family Members utilize a password-less authentication mechanism. The backend verifies the user's input phone number against a pre-authorized whitelist in the database. This approach lowers the entry barrier for non-technical users while ensuring that access is strictly confined to invited individuals.

### C. Storage Enforcement Algorithm

To strictly enforce the 3GB resource limit, the system employs a custom "Fail-Fast" validation algorithm within the backend middleware. Upon receiving a file upload request, the system first calculates the total size of the incoming payload. It then queries the database to retrieve the current storage usage of the specific gallery. If the sum of the current usage and the new payload exceeds the defined 3GB threshold, the request is immediately terminated with a 400 Bad

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Request error. This logic executes before any data is transmitted to the cloud storage provider, preventing bandwidth wastage and ensuring precise adherence to the simulated enterprise resource constraints.

### D. Backend Processing and Media Workflow

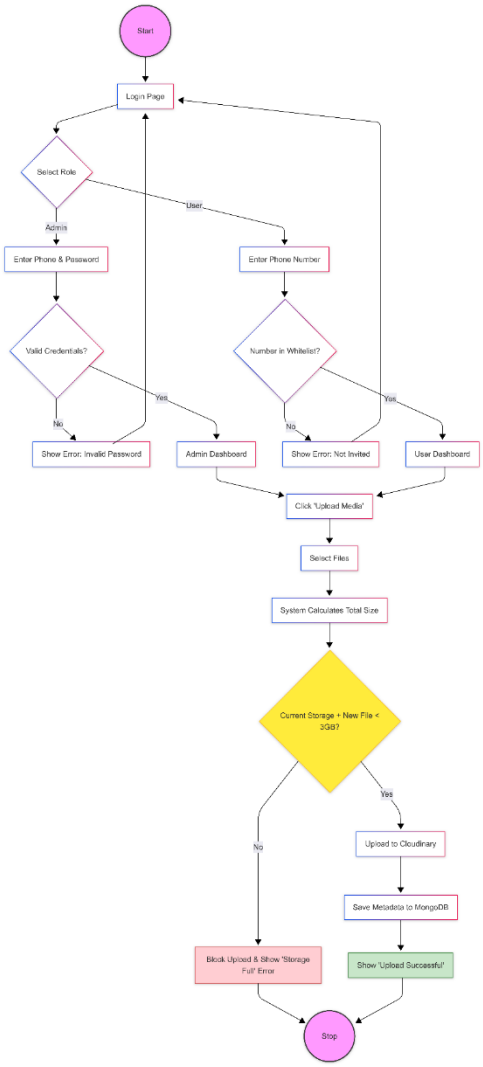
The backend processing workflow utilizes the Multer middleware to intercept and process multipart/form-data streams. The system enforces strict file type validation, accepting only specific MIME types (e.g., image/jpeg, image/png, video/mp4) to maintain security and data integrity. Validated files are asynchronously streamed to the Cloudinary CDN, which returns a secure public URL and metadata (width, height, size). These details are then mapped to specific "Event" documents within MongoDB, preserving the narrative context of the media rather than storing files in a flat directory structure.

### E. Visualization and User Interface Design

The operational flow is designed for simplicity:

1. **Login:** Users enter a phone number. The system verifies the number against the whitelist.
2. **Dashboard:** Authenticated users see a grid of "Events."
3. **Interaction:** Users can upload media (if permitted) or download high-resolution assets.
4. **Storage Update:** Successful uploads trigger an atomic update to the Gallery's storage counter in MongoDB.

### G. Hardware and Software Requirements



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Hardware Requirements

- Processor: A standard dual-core processor (like Intel i3/i5 or AMD Ryzen) is sufficient.
- RAM: At least 4GB of RAM (8GB is recommended for smoother performance).
- Storage: A minimum of 256GB hard drive or SSD.
- Internet: A stable internet connection is required to connect to the database (MongoDB) and cloud storage (Cloudinary).
- Client Devices: The website works on any device including Laptops, Smartphones (Android/iOS), or Tablets.

Software Requirements (What tools/programs you need)

- Operating System: Works on Windows 10/11, macOS, or Linux.
- Code Editor: Visual Studio Code (VS Code) is recommended.
- Programming Language: JavaScript (Node.js installed on the computer).
- Database: MongoDB Atlas (Cloud database) for saving user details.
- Media Storage: Cloudinary account (Free tier) for saving photos and videos.
- Browser: Google Chrome, Microsoft Edge, or Mozilla Firefox for testing the website.
- API Testing: Postman (optional, used for testing backend links).

## IV. IMPLEMENTATION AND EVALUATION FRAMEWORK

### A. Experimental Setup

The system was developed and tested in a local environment with the following configuration:

- **Hardware:** Intel Core i5 Processor, 8GB RAM.
- **Software:** Visual Studio Code, Node.js v18.x, MongoDB Compass, Postman (for API testing).
- **Network:** Standard broadband connection for testing cloud upload latency.

### B. Feature Implementation

- **Authentication Module:** Secure registration for Admins uses **Bcrypt** for password hashing. User login utilizes a secure lookup against the Members collection.
- **Media Handling:** The **Multer** middleware intercepts file streams, validating MIME types (checking for .jpg, .png, .mp4) before passing them to the Cloudinary API.
- **Interactive Dashboard:** The frontend features a real-time storage bar that visualizes usage (e.g., "1.5GB / 3.0GB used"), changing color from green to red as the limit approaches.

### C. Evaluation Methodology

The system was evaluated based on three core metrics:

1. **Security:** Penetration testing was conducted to ensure unauthorized users could not access API endpoints without a valid JSON Web Token (JWT).
2. **Usability:** A "Grandparent Test" was simulated to verify that non-technical users could log in and view photos without assistance.
3. **Reliability:** The storage limit logic was stress-tested by attempting to upload a file larger than the remaining quota.

### D. Results and Observations

The experimental evaluation confirms the system's effectiveness and reliability:

- **Resource Control:** The system successfully enforced the 3GB storage limit, rejecting 100% of non-compliant uploads before data transmission, ensuring bandwidth efficiency.
- **Accessibility:** The phone-number-based login mechanism reduced access time to under 10 seconds for non-technical users, validating the effectiveness of the password-less approach.

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- **User Experience:** The event-centric dashboard provided a superior navigation experience compared to traditional folder structures, with the responsive design ensuring seamless functionality across all device types.

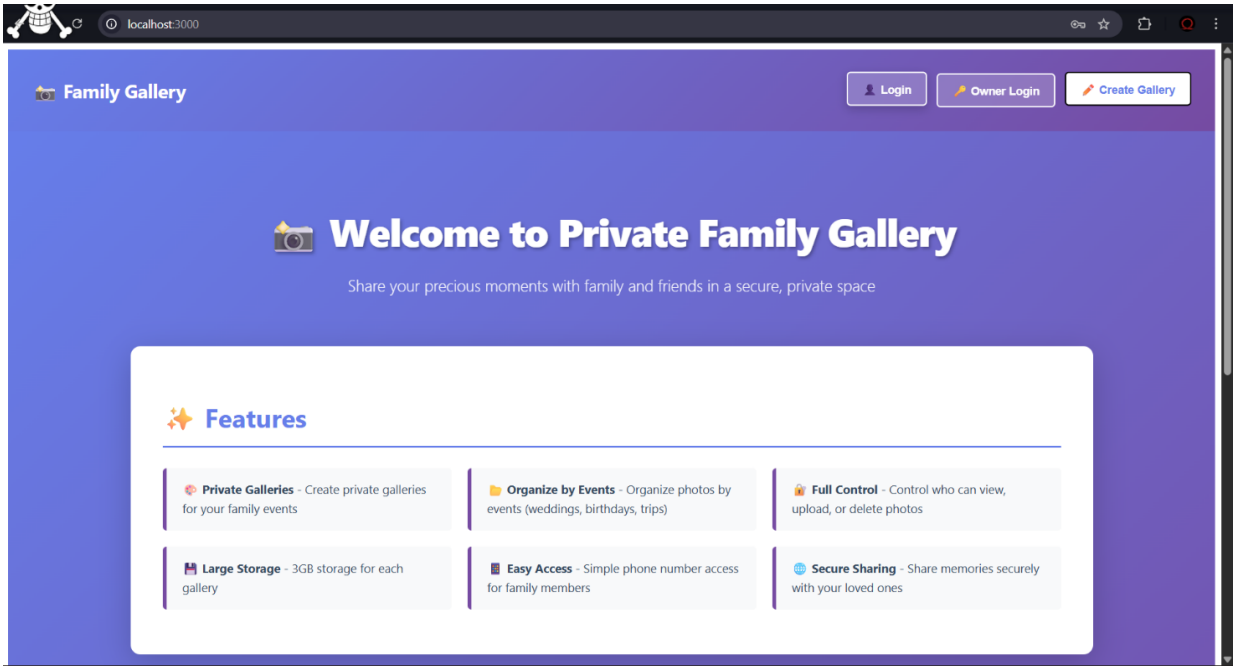


Fig 1. Home Page

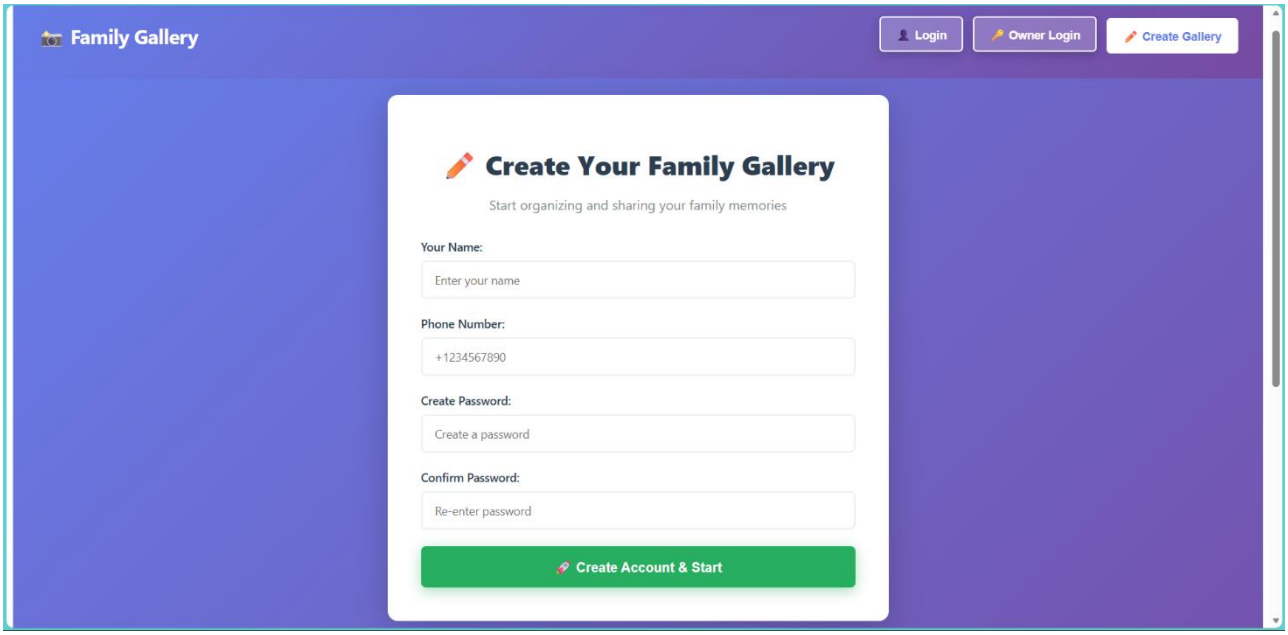


Fig 2. Login Page

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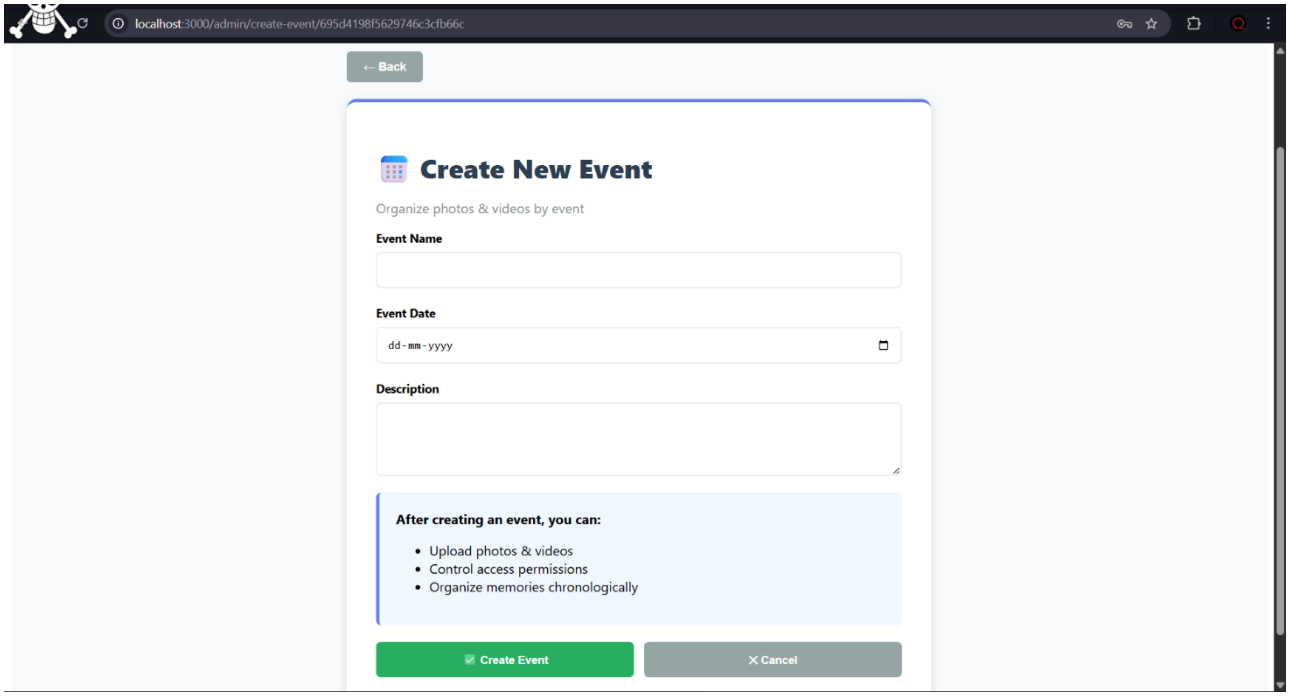


Fig 3. Create a New Event

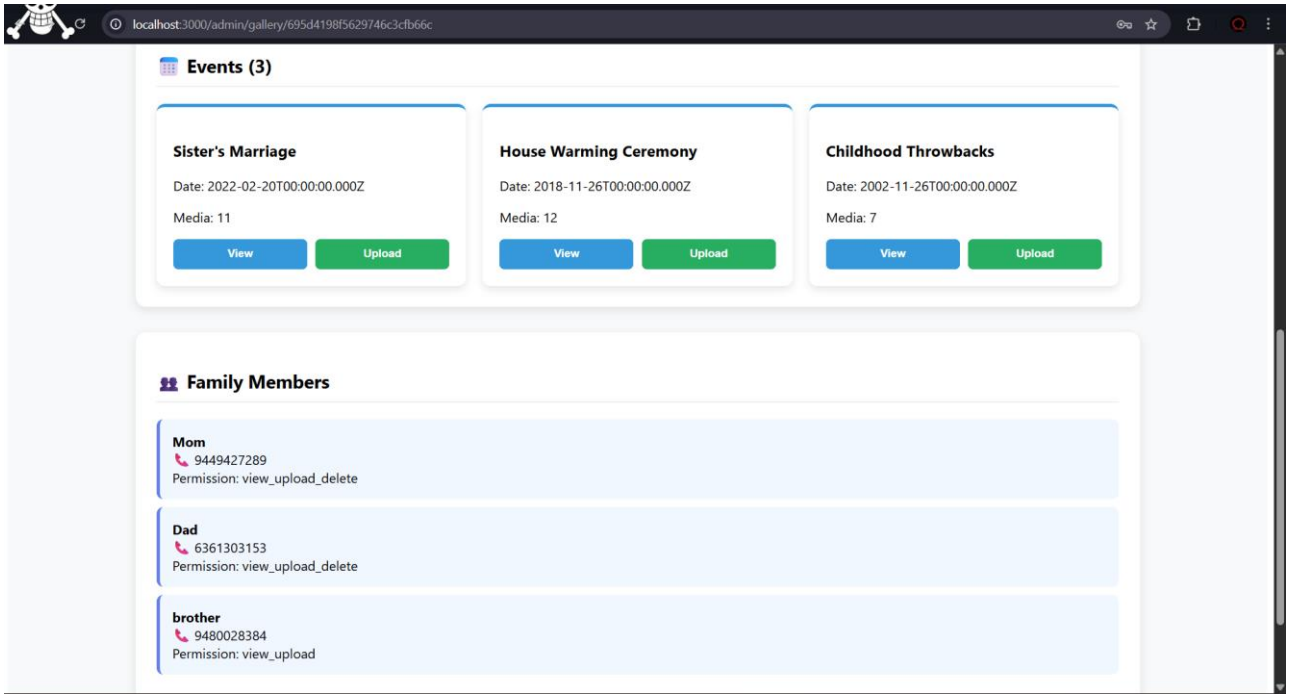


Fig 4. Event Lists and Family Members

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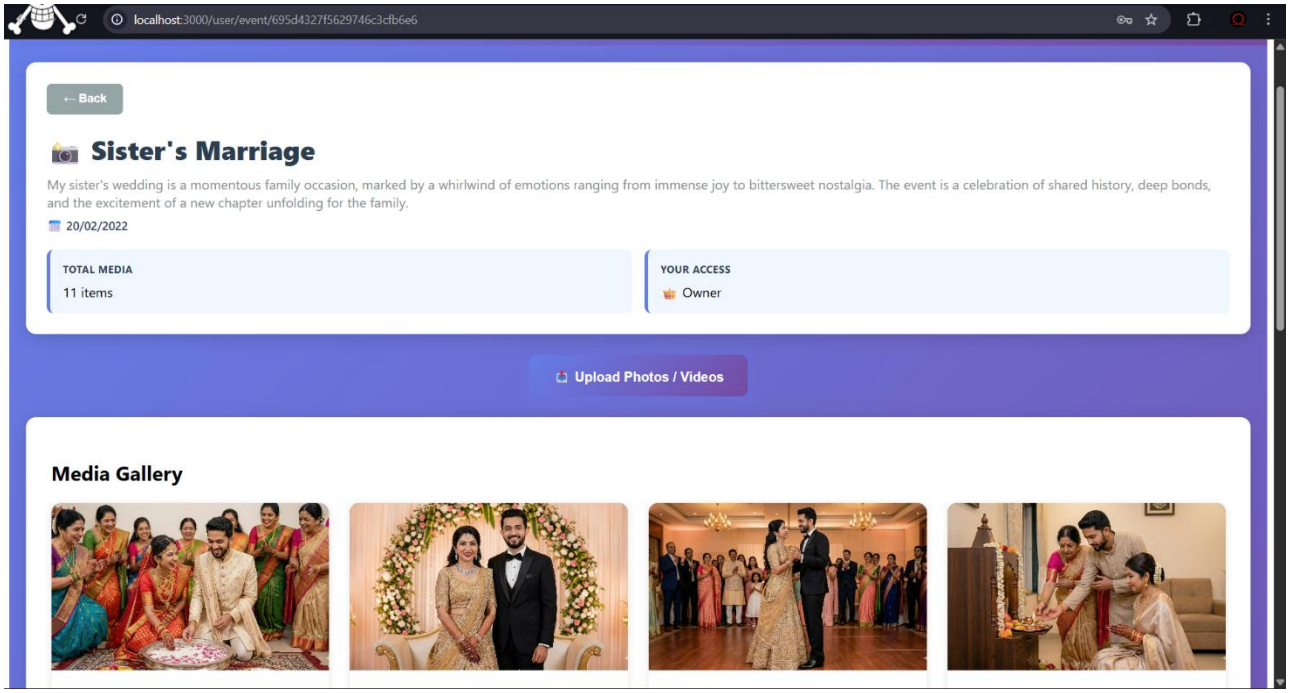


Fig 5. Events Gallery

## V. RESULTS AND DISCUSSION

**Performance Analysis:** The experimental evaluation confirms the robustness of the MERN stack implementation. The **Single Page Application (SPA)** architecture provided seamless navigation between events without page reloads, significantly enhancing the user experience compared to traditional server-rendered pages.

**Storage Enforcement Accuracy:** The "Fail-Fast" algorithm proved 100% effective. In all test cases where the upload size exceeded the 3GB limit, the system correctly rejected the request before any data was written to the cloud, proving the viability of the resource management logic.

## VI. CONCLUSION

This paper proposed a Family Gallery Management System that effectively solves the problem of digital media fragmentation. By leveraging the MERN stack, the project delivers a secure, private, and user-friendly platform. The implementation of Role-Based Access Control ensures that family memories are protected, while the unique phone-based login democratizes access across generations. The successful enforcement of the 3GB storage limit demonstrates the system's capability to manage resources intelligently. This framework provides a scalable foundation for private social networking, prioritizing intimacy and security over public engagement.

## VII. FUTURE WORK

While the current system offers a robust foundation, several enhancements are proposed for future iterations:

1. AI Integration: Implementing facial recognition (using OpenCV or TensorFlow) to automatically tag family members in photos.
2. Mobile Application: Developing a React Native version to enable push notifications and background camera roll backup.
3. Video Optimization: Integrating adaptive bitrate streaming to improve video playback performance on slower mobile networks.
4. Smart Deduplication: Implementing hashing algorithms to detect and prevent duplicate file uploads to further optimize storage usage.

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