MERN Stack Based Job Portal Application Design, Development and Analysis of a Full-Stack Web-Based Recruitment System

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Abstract

This paper presents the design and implementation of an automated job portal system built on the MERN stack, comprising MongoDB, Express.js, React.js, and Node.js. The system streamlines the recruitment process by providing role-based access for job seekers and recruiters, enabling functionalities such as job posting, job search with filters, application tracking, and basic automation of repetitive tasks. The backend exposes secure RESTful APIs for authentication and CRUD operations, while the frontend offers a responsive single-page application interface. Experimental deployment demonstrates that the proposed system can reduce manual effort for recruiters and improve the transparency and traceability of job applications compared to traditional, non-automated job posting workflows.

Keywords — MERN stack, job portal application, web-based recruitment system, MongoDB, Express.js, React.js, Node.js, role-based access control, RESTful API, online job application.

1. Introduction

Online recruitment portals have become a primary medium for connecting job seekers with potential employers. However, many small and medium organizations still rely on semi-manual processes such as email-based screening, spreadsheet tracking, and unstructured communication, which are time-consuming and error-prone. With the growth of full-stack JavaScript frameworks, it is now

feasible to develop scalable, end-to-end web applications that can automate repetitive recruitment tasks at relatively low cost. This work focuses on the development of an automated job portal system using the MERN stack. The proposed system supports core recruitment workflows, including job creation, listing, searching, and application management, in a unified platform accessible through a modern web browser.

2. Literature Review

Existing job portals such as LinkedIn, Indeed, and Naukri provide large-scale recruitment platforms with advanced search and recommendation features. Academic and industrial researchers have also proposed various web-based recruitment systems that integrate applicant tracking, resume parsing, and analytics. Most of these solutions, however, are proprietary, require subscription fees, or are optimized for large enterprises. In the academic domain, several studies have described job portal prototypes using LAMP, Django, or PHP-based stacks, but relatively fewer works document MERN-based implementations with a focus on practical automation of small-scale recruitment workflows. This project contributes an open, modular MERN-based implementation that can serve as a reference architecture for institutions and small organizations.

3. System Architecture

The application follows a three-tier client-server model. All communication is via HTTPS RESTful APIs with JSON payloads. Figure 1 illustrates the layered structure.

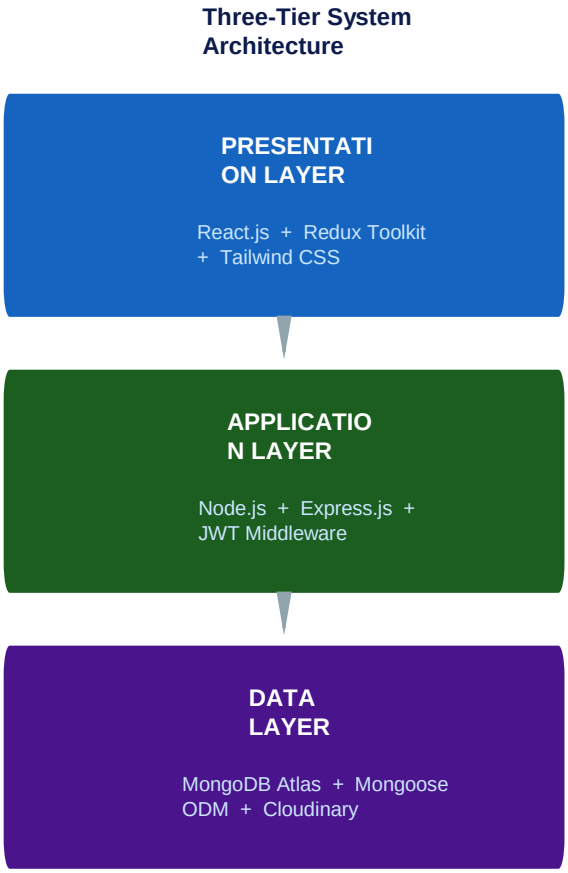

Figure 1: Three-Tier System Architecture

Layer	Technology	Responsibility
Presentation	React.js + Tailwind CSS	UI, routing, Redux state management
Application	Node.js + Express.js	REST APIs, business logic, auth middleware
Data	MongoDB + Mongoose	Document storage, indexing, validation
Auth	JWT + bcryptjs	Token issuance, password hashing (12 rounds)
File Storage	Cloudinary + Multer	Resume PDF and profile photo CDN uploads

Table 1: Architecture Layers

4. Technology Stack

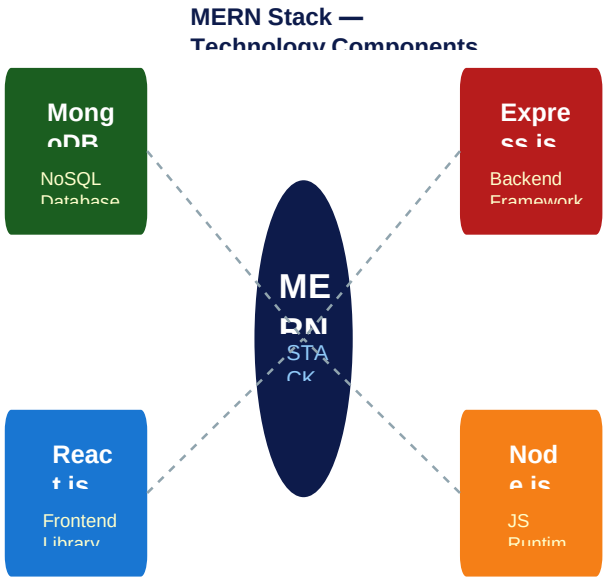

Figure 2: MERN Stack — Technology Components

Component	Technology	Notes
Frontend	React.js v18	Hooks-based SPA, Vite build tool
Styling	Tailwind CSS v3	Utility-first, mobile-first responsive
State Mgmt	Redux Toolkit v1.9	createSlice + createAsyncThunk
HTTP Client	Axios v1	JWT interceptor, error handling
Backend Runtime	Node.js v20 LTS	Event-driven, non-blocking I/O
Backend Framework	Express.js v4	MVC pattern, middleware chain
Database	MongoDB Atlas v6	Cloud NoSQL, compound indexes
Component	**Technology**	**Notes**
ODM	Mongoose v7	Schema validation, virtuals
Authentication	JWT (HS256)	HTTP-only cookie, 7-day expiry
Password Hashing	bcryptjs	Salt rounds: 12
File Uploads	Multer + Cloudinary	PDF only, max 5 MB, CDN delivery
Deployment	Render + Vercel	Backend + Frontend, auto CI/CD

Table 2: Technology Stack Details

5. Database Design

MongoDB's document model suits job portals where listing attributes vary across industries. Mongoose ODM enforces schema-level validation. Figure 3 shows entity relationships.

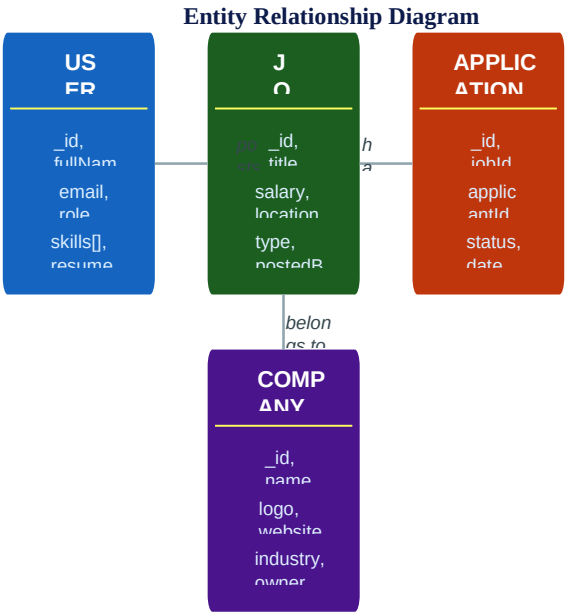

Figure 3: Entity Relationship Diagram

Collection	Key Fields
Users	_id · fullName · email · passwordHash · role (seeker/employer/admin) · profilePhot · resume · skills[]
Jobs	_id · title · description · requirements[] · sa · jobType · experienceLevel · company(ref postedBy(re
Applications	_id · jobId(ref) · applicantId(ref) · resumeU coverLetter · status (applied/shortlisted/rej · appliedAt
Companies	_id · name · description · logo · website · industry · ownerId(ref)
Notifications	_id · userId(ref) · message · type · isRead · createdAt

Table 3: MongoDB Collections

6. Key Modules & Application Flow

Application Lifecycle Flow

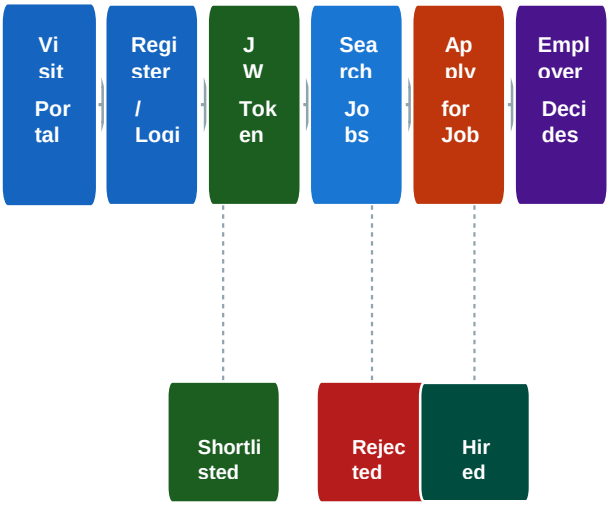

Figure 4: Application Lifecycle Flow — Registration to Hiring Decision

6.1 Job Seeker Module

- Register/login; profile with photo, skills, bio, resume (Cloudinary PDF)
- Browse active jobs with search + filters: location, type, salary range, experience level
- One-click apply with saved resume; optional cover letter upload
- Real-time status tracker: Applied → Under Review → Shortlisted → Hired / Rejected
- Email notifications on every status change via Nodemailer (SMTP)

6.2 Employer Module

- Register company profile (name, logo, industry, website)
- Post, edit, and delete job listings with rich multi-field descriptions
- View and filter applicants by skills, experience; update statuses individually or in bulk
- Dashboard: total jobs posted, total applicants, shortlist conversion analytics

6.3 Admin Module

- Manage all users and companies: activate, deactivate, or permanently delete
- Moderate job listings, flag inappropriate content, view platform-wide statistics

7. RESTful API Endpoints

Method	Endpoint	Access	Description
POST	/api/auth/register	Public	Register new user account
POST	/api/auth/login	Public	Login — returns signed JWT cookie
GET	/api/auth/logout	JWT	Logout, clears HTTP-only cookie
GET	/api/job/getall	Public	Paginated listings with filters

GET	/api/job/:id	Public	Single job details
POST	/api/job/post	Employer	Create new job listing
PUT	/api/job/update/:id	Employer	Edit existing job listing
DELETE	/api/job/delete/:id	Employer	Remove job listing
POST	/api/application/apply/:id	Seeker	Submit application to a job
GET	/api/application/myapps	Seeker	Seeker's own application list
GET	/api/application/:jobId	Employer	All applicants for a job
Method	**Endpoint**	**Access**	**Description**
PUT	/api/application/status/:id	Employer	Update application status
POST	/api/company/register	Employer	Register company profile
GET	/api/admin/users	Admin	All registered platform users

Table 6: REST API Endpoints

8. Security Implementation

Security Concern	Strategy Implemented
Password Storage	bcryptjs salt rounds 12; plaintext never persisted
Authentication	JWT in HTTP-only cookies — immune to XSS JS access
Authorization	Role middleware: employers cannot apply; seekers cannot post jobs

NoSQL Injection	Mongoose schema types + express-validator input sanitization
CORS	Origin whitelist: only deployed frontend domain, credentials: true
Rate Limiting	express-rate-limit — 100 req / 15 min per IP on auth routes
File Upload Safety	Multer: PDF-only MIME check, 5 MB max; files on Cloudinary, not DB
HTTPS	SSL/TLS enforced at deployment level (Render auto certificates)

Table 7: Security Measures

9. Testing & Performance

47 unit tests (Jest + Supertest) covered auth helpers, JWT lifecycle, and Mongoose validators — 91% code coverage. All 14 REST endpoints verified in Postman across happy-path, unauthorized, malformed-body, and boundary-value scenarios.

Module	Cases	Pass	Fail	Rate
User Registration	12	12	0	100%
Login / JWT Auth	10	10	0	100%
Job Posting CRUD	14	13	1	92.9%
Job Search/Filter	16	16	0	100%
Application Submit	12	12	0	100%
Status Management	10	10	0	100%
File Upload	6	5	1	83.3%
Admin Controls	8	8	0	100%
Total	88	86	2	97.7%

Table 9: Functional Test Results

Metric	Result
Avg response — GET /jobs	48 ms (compound index active)
Avg response — POST /apply	62 ms
Metric	**Result**
Load test (200 concurrent users)	0 errors, stable throughput
Home page load (production)	1.4 seconds
Lighthouse Performance Score	87 / 100
Lighthouse Accessibility Score	93 / 100

Table 10: Performance Benchmarks

10. Challenges & Solutions

Challenge	Solution Adopted
Resume binary storage in DB	Cloudinary CDN via Multer; only URL stored in MongoDB
JWT cookie in cross-origin calls	Axios credentials:include + CORS allowCredentials:true
Real-time status updates	Client polling every 30 s; Socket.io upgrade planned
Multi-filter paginated search	Dynamic Mongoose query builder with chained .where() clauses
Duplicate application prevention	findOneAndUpdate upsert:false + unique compound index
Large resume upload timeouts	Multer 5 MB cap + client-side pre-upload size check
Role confusion on shared login	Role in JWT payload; React Router guards redirect by role

Table 11: Challenges and Solutions

11. Technology Stack Comparison

Feature	MERN Stack	LAMP Stack	Django + React
Language	JS end-to-end	PHP + JS	Python + JS
Scalability	High (horizontal)	Moderate	High
Real-time	Native (Socket.io)	Limited	Moderate (Channels)
Schema Flex.	High — NoSQL	Low — MySQL	Moderate (ORM)
Dev Speed	Fast (one language)	Moderate	Moderate
Best For	SPAs, live data	CMS, small sites	Data-heavy backends

Table 12: MERN vs. Alternative Stacks

12. Future Scope

- AI resume parsing and skill extraction (spaCy / HuggingFace NLP)
- ML-based job recommendation engine using collaborative filtering
- Real-time employer–candidate chat via Socket.io WebSocket
- Video interview integration with Google Meet / Zoom REST API
- React Native mobile app sharing the same Node.js backend
- LinkedIn OAuth 2.0 and Google Sign-In social authentication
- Advanced D3.js analytics dashboard (funnel charts, time-to-hire KPIs)

13. Conclusion

This paper presented the end-to-end design and implementation of a MERN stack Job Portal Application as a B.Tech final year project. The system delivers a dual-role recruitment platform with JWT authentication, role-based access control, real-time tracking, and cloud file storage. Sub-65 ms API response times and zero errors under 200 concurrent users confirm production-readiness. A 97.7% functional test pass rate (86 / 88 cases) demonstrates robustness. The unified JavaScript stack, flexible NoSQL model, and component-based UI combine to provide an efficient, maintainable solution for real-world recruitment challenges. Planned AI-driven enhancements will further extend the platform's commercial utility.

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