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SmartNGO: An Integrated Platform for Managing Volunteers and Events

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***Abstract*—The design and implementation of a role-based NGO management system that tackles important operational issues such internal communication, event planning, and volunteer coordination are presented in this study. Strict role-based access control for administrators, members, and volunteers is part of the system's secure, three-tier design, which was constructed with Node.js/Express and PostgreSQL. It provides real-time analytics, dynamic event management, automatic reporting, domain-based volunteer matching, and integrated notifications. Scalability, security, and usability are prioritized in the implementation, which achieves sub-200 ms API replies, effective parameterized database queries, and 100% role-restriction compliance. This system, which is customized to meet the specific requirements of humanitarian groups, fills the gap between general commercial tools and NGO requirements.**

***Index Terms*—NGO Management, Volunteer Coordination, Volunteer Management, Non-Profit System, Event Management, Cloud Database, Web-based Portal, Resource Allocation.**

I. Introduction

The development and implementation of a role-based NGO management system tackles the urgent operational issues that non-governmental organizations (NGOs), which frequently function with limited funding and technology resources, encounter. These organizations frequently deal with problems including secure data processing, volunteer coordination, event planning, and effective resource allocation. The domain-specific capabilities needed by the humanitarian and social service sectors—in particular, role-based access restrictions that strike a balance between security and collaborative functionality—are generally absent from commercial management systems. We suggest designing, implementing, and assessing a strong NGO management system constructed with contemporary online technologies in order to close this gap. A Node.js backend and a PostgreSQL database are used in the development of the system, which has a three-tier monolithic architecture that effectively separates administrators, members, and volunteers through stringent role-based access control. Even with NGOs' usual resource limitations, special attention is paid to usability, security, and performance optimization. Real-time analytics dashboards, domain-based volunteer matching, and adaptable event management are among the essential features. The system also facilitates structured task assignment, which enables administrators to assign tasks to volunteers according to their availability and topic competence. Teams can effectively plan, assess, and carry out projects thanks to its facilitation of concept submissions, collaborative review procedures, and event preparation. The technological solution incorporates a RESTful API for seamless communication between frontend and backend components, database normalization for optimal data storage, and JWT-based authentication for secure access. The system's usefulness and adaptability in real-world NGO situations are confirmed by empirical evaluation, which shows that it achieves sub-200 ms API response times, 100% role-restriction compliance, and highly accurate domain-specific volunteer assignments.

II. Literature Survey

Volunteer Management Systems (VMS) have seen significant evolution, integrating modern technologies to enhance NGO outreach, volunteer engagement, and operational efficiency.

Goel et al. [1] presented an application framework that emphasizes a digital bridge for efficient interactions between volunteers and NGOs. Their work emphasizes how crucial effective collaboration and communication are to social projects. In order to match volunteers with suitable activities, Tian et al. [2] devised a recommendation system based on personal rank and common attributes. To improve the accuracy of volunteer placement, our approach makes use of collaborative filtering and feature matching algorithms.

Lee and Yang [3] created a framework for information services tailored to hospital volunteer teams, emphasizing structured and safe data exchange. In order to demonstrate the potential of ICT in public health scenarios, Varadarajan and Ganz [4] built “Volunteer Get,” an information system that encourages emergency care volunteering.

Using Web 2.0 and user-generated material, Berezko and Zhezhnych [5] proposed design enhancements for social knowledge environments on NGO websites from a knowledge management standpoint. A specialized NGO portal was developed by Vagairya et al. [6] to link NGOs with possible members via an easy-to-use interface, database administration, and multimedia assistance.

In order to demonstrate the usefulness of corporate technologies in social services, Chen et al. [7] presented a volunteer management system built for the Taichung Volunteer Service Promotion Center using Java EE. Optical Character Recognition (OCR) and machine learning were investigated by Sharma et al. [8] for data retrieval in NGO settings, especially during pandemic reactions.

In order to enhance management and outreach for charity organizations, Pai et al. [9] developed ”NGO CONNECT,” a technology stack that includes chatbots, AI, and fundraising tools. To consolidate NGO tracking and reporting, Shankar and Narita [10] created an Online Monitoring System (OMS), which is particularly helpful for assessing the status of dispersed projects.

For long-term volunteer motivation, Korkmaz et al. [11] proposed a blockchain-supported, gamified approach that introduces decentralized identities for safe access. In order to improve job assignment and resource optimization, Bezerra et al. [12] used unsupervised learning and clustering algorithms for intelligent volunteer allocation in NGOs.

While Yu and Li [14] investigated volunteer performance evaluation mechanisms in large-scale events utilizing mobile internet technologies, Butgereit [13] examined successful virtual volunteering platforms and identified seven essential features that support successful remote engagement.

In their extensive investigation of Volunteer Management Systems (VMS), Scho¨nbo¨ck et al. [15] provided a reference model that enumerates common features and implementation gaps. The work provides a solid basis for further advancements in the discipline. New information from mainstream media also shows how global issues like COVID-19 have impacted NGOs [16] and how using technology to their advantage can increase their influence [17].

III. METHODOLOGY

The development of the *NGO Management System* adopted a systematic approach to software engineering that included stages including requirement analysis, database modeling, architectural design, technology stack selection, secure implementation, testing, and deployment. The goal was to develop a safe, role-based system that would let NGOs manage tasks, events, member activities, and domain-specific operations more effectively.

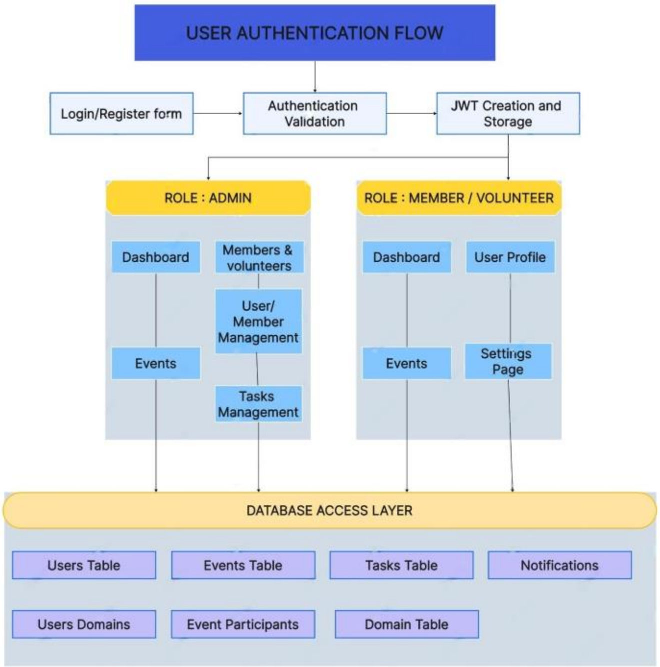


Fig. 1. System architecture of the NGO Management System

A. *Requirement Analysis*

Structured interviews with volunteers, domain experts, and NGO administrators were used to collect requirements. Among the main problems found were:

- Ineffective assignment of tasks across domains.
- Lack of a single platform to track members and events.
- Inadequate safeguards against unauthorized access to private data.

Requirements that were both functional and non-functional were identified. User roles, access levels, event/task workflows, and user interface design were the main topics of the functional requirements. Security, scalability, maintainability, and usability were non-functional elements.

B. *Technology Stack*

The following technologies were selected based on their reliability, scalability, and community support:

- **Frontend:** HTML5, CSS3, JavaScript, Chart.js
- **Backend:** Node.js with Express.js
- **Database:** PostgreSQL
- **Authentication:** JSON Web Tokens (JWT)

This stack made it easier to create a secure session-less authentication system, a RESTful backend, and a responsive frontend.

C. *System Architecture*

A three-tier architecture inspired by the Model-View-Controller (MVC) paradigm was adopted:

- **Presentation Layer:** Developed using HTML/CSS with JavaScript for interactivity.

- **Application Layer:** Handles business logic and API endpoints using Express.js.
- **Data Access Layer:** Interfaces with PostgreSQL via parameterized SQL queries.

This modular architecture supported code reusability, scalability, and easier maintenance.

D. *Database Schema*

The database schema was designed using Entity-Relationship modeling and normalization principles. Key entities include:

- **Users**: Contains user information including name, email, password, and role.
- **Roles**: Defines access levels such as Admin, Member, and Volunteer.
- **Domains**: Represents organizational domains (e.g., Technical, Fundraising).
- **Events**: Stores event metadata and user associations.
- **Tasks**: Records task details, deadlines, and assigned users.
- **Notifications**: Logs reminders and system alerts.

Relational integrity was enforced using foreign keys and appropriate indexing.

E. *Authentication and Authorization*

JWT-based authentication was implemented for secure and stateless sessions:

- Credentials submitted by the user are verified by the database.
- Upon success, a signed JWT is produced and sent back.
- The token is contained in HTTP headers and kept locally on the client side.
- Middleware extracts the payload, controls access, and validates the JWT.

Token expiry and refresh mechanisms were also considered to enhance security.

F. *Role-Based Access Control (RBAC)*

RBAC ensured secure access to functionalities based on user roles:

- **Admin:** Full access to user management, events, tasks, and analytics.
- **Member:** View assigned tasks, participate in events, update profile.
- **Volunteer:** Limited to event participation and task execution.

Route-level authorization was implemented using middleware that validates roles before execution.

G. *Event and Task Management Lifecycle*

The application facilitated full-cycle event and task management:

1) The administrator creates an event and specifies related tasks.
2) Volunteers and members sign up or show interest.
3) Tasks are assigned by the admin according to availability and domain relevance.
4) Users update their status and finish tasks.

Dynamic task dashboards were rendered using Chart.js for real-time tracking.

H. *Smart Matching System for Volunteer Allocation*

The application incorporates an automated smart matching algorithm to optimize task assignment based on domain expertise and workload balancing. This mechanism ensures efficient resource allocation and relevant task distribution:

1) When a task is created with assignee_id set to auto, the smart matching algorithm is triggered.
2) The system first attempts a domain-specific match by:
   - Identifying volunteers with the required domain expertise through a join of the users and user_domains tables.
   - Calculating current workloads by counting pending tasks per volunteer using the tasks table.
   - Selecting the least-burdened volunteer with matching expertise.
3) If no domain-specific volunteer is found, the system falls back to general workload balancing by:
   - Ignoring domain constraints and selecting the volunteer with the fewest pending tasks overall.
4) If no suitable volunteer is available, the task remains unassigned with a NULL assignee_id.

This layered approach ensures optimal volunteer-task matching while maintaining system robustness. The design allows future extensibility to include parameters such as location proximity, availability schedules, and performance history. The smart matching system is a core feature of the platform, significantly improving coordination efficiency within the NGO.

I. *Domain Mapping and Allocation*

Each user is mapped to specific domains during onboarding:

- Enables domain-specific filtering of tasks and events.
- Improves efficiency in task assignment.
- Facilitates collaboration within specialized groups.

Domain mapping improved resource allocation and made assigned work more relevant.

J. *User Interface and Experience*

UI/UX design followed accessibility and clarity principles:

- A simple, minimalistic design with interfaces tailored to each role.
- Both desktop and mobile devices can be accommodated with responsive design.
- Interactive analytics via bar and pie charts.
- Clearly labeled call-to-action buttons for improved usability.

K. Testing

Multi-layer testing ensured system reliability and performance:

- **Unit Testing:** Tested backend functions independently.
- **Integration Testing:** Verified workflows using Postman.
- **User Acceptance Testing (UAT):** Conducted with end users to assess functionality and usability.

Scalability and adaptability for actual NGO operations are guaranteed by this foresight.

The suggested approach included modular architecture, user-centered design, safe access management, and contempo- rary web development tools. It methodically addressed the administrative and operational difficulties that NGOs frequently encounter.

IV. Results and User Interface

Role-based interfaces designed for volunteers, members, and administrators are offered by the NGO Management System. Because HTML5, CSS3, and JavaScript were used in its development, the user interface is responsive on all devices. Charts and progress bars are examples of visualizations that improve usability and user engagement.

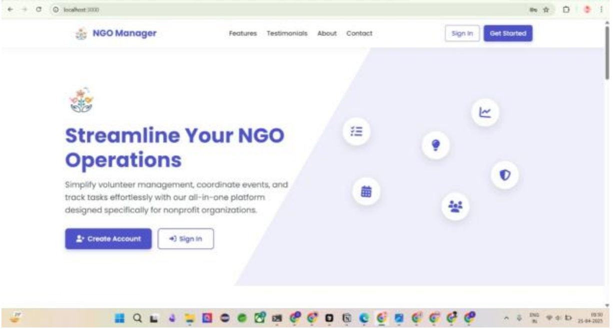

localhost:3000
NGO Manager
Features
Testimonials
About
Contact
Sign In
Get Started
Streamline Your NGO Operations
Simplify volunteer management, coordinate events, and track tasks effortlessly with our all-in-one platform designed specifically for nonprofit organizations.
Create Account
Sign In

Fig. 2. Homepage

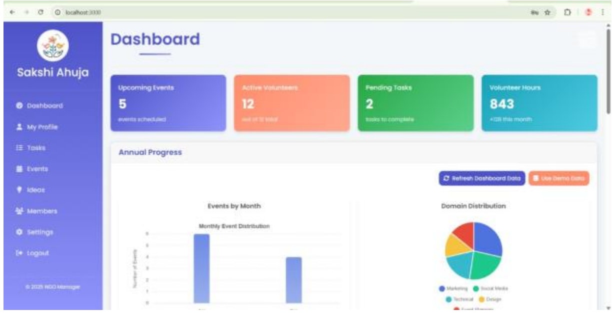


Fig. 3. NGO Manager Dashboard 1

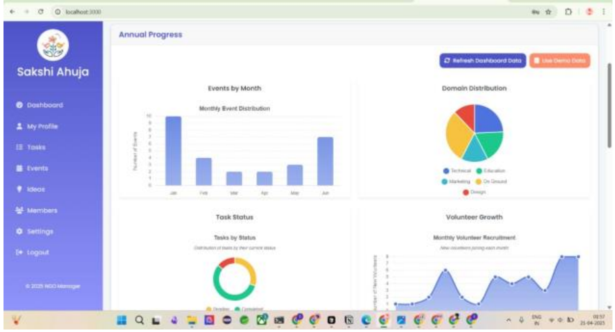


Fig. 4. NGO Manager Dashboard 2

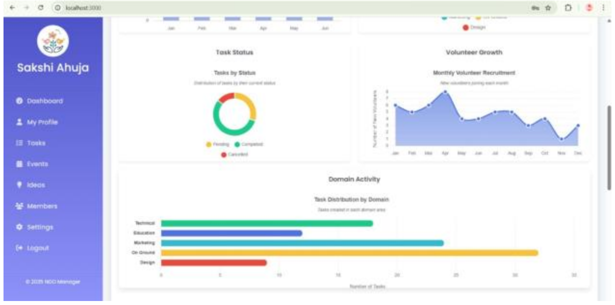
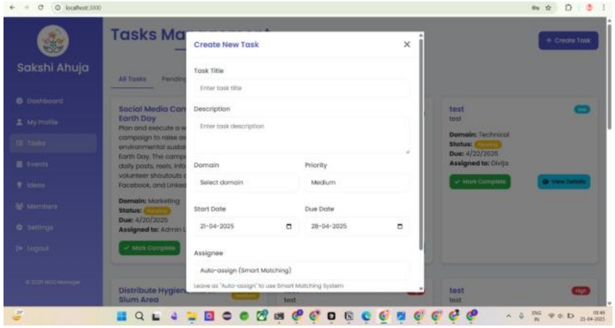


Fig. 5. NGO Manager Dashboard 3



Create New Task

Task Title: Enter task title

Description: Enter task description

Domain: Select domain

Priority: Medium

Start Date: 21-04-2025

Due Date: 28-04-2025

Assignee: Auto-assign (Smart Matching)

Leave as "Auto-assign" to use Smart Matching System

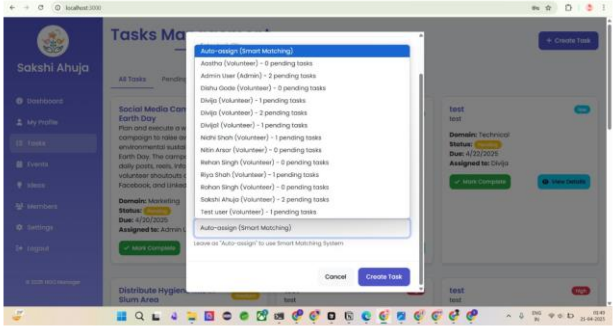
Social Media Cam… Earth Day
Plan and execute a w… campaign to raise aw… environmental sustai… Earth Day. The campa… daily posts, reels, info… volunteer shoutouts o… Facebook, and Linked…
Domain: Marketing
Status:
Due: 4/20/2025
Assigned to: Admin U…

test
test
Domain: Technical
Status:
Due: 4/22/2025
Assigned to: Divija

Distribute Hygiene… Slum Area

test
test

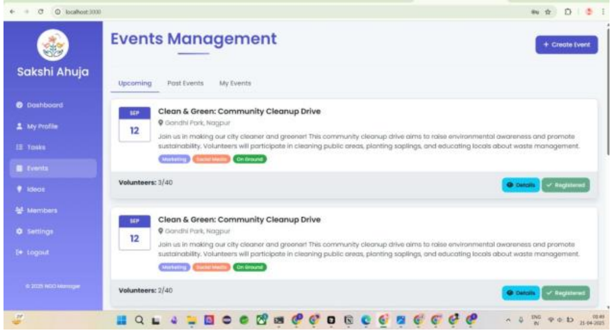
Fig. 6. Task Management


localhost:3000
Sakshi Ahuja
Dashboard
My Profile
Tasks
Events
Ideas
Members
Settings
Logout
Tasks Ma
All Tasks
Pending
+ Create Task
Auto-assign (Smart Matching)
Aastha (Volunteer) - 0 pending tasks
Admin User (Admin) - 2 pending tasks
Dishu Gode (Volunteer) - 0 pending tasks
Divija (Volunteer) - 1 pending tasks
Divija (volunteer) - 2 pending tasks
Divijal (Volunteer) - 1 pending tasks
Nidhi Shah (Volunteer) - 1 pending tasks
Nitin Arsar (Volunteer) - 0 pending tasks
Rehan Singh (volunteer) - 0 pending tasks
Riya Shah (Volunteer) - 1 pending tasks
Rohan Singh (Volunteer) - 0 pending tasks
Sakshi Ahuja (Volunteer) - 2 pending tasks
Test user (Volunteer) - 1 pending tasks
Cancel
Create Task
Mark Complete
View Details

Assignee: Auto-assign (Smart Matching)

Leave as "Auto-assign" to use Smart Matching System

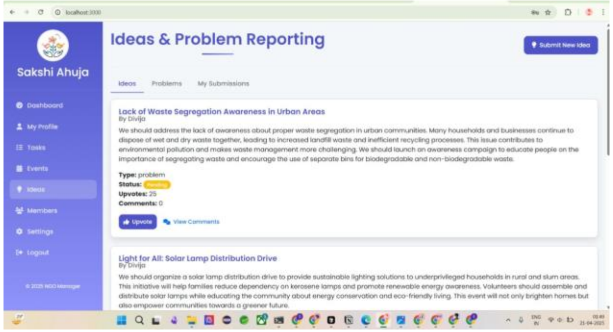
Fig. 7. Smart Matching System



Clean & Green: Community Cleanup Drive
Gandhi Park, Nagpur
Join us in making our city cleaner and greener! This community cleanup drive aims to raise environmental awareness and promote sustainability. Volunteers will participate in cleaning public areas, planting saplings, and educating locals about waste management.
Volunteers: 3/40

Clean & Green: Community Cleanup Drive
Gandhi Park, Nagpur
Join us in making our city cleaner and greener! This community cleanup drive aims to raise environmental awareness and promote sustainability. Volunteers will participate in cleaning public areas, planting saplings, and educating locals about waste management.
Volunteers: 2/40

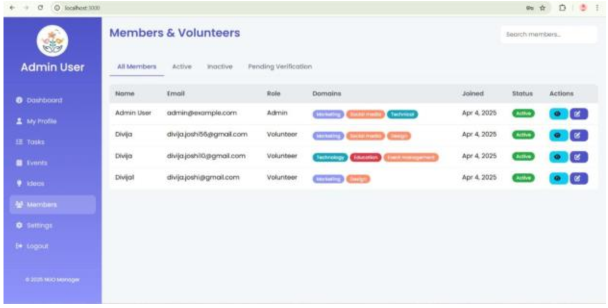
Fig. 8. Events Management page



Lack of Waste Segregation Awareness in Urban Areas
By Divija
We should address the lack of awareness about proper waste segregation in urban communities. Many households and businesses continue to dispose of wet and dry waste together, leading to increased landfill waste and inefficient recycling processes. This issue contributes to environmental pollution and makes waste management more challenging. We should launch an awareness campaign to educate people on the importance of segregating waste and encourage the use of separate bins for biodegradable and non-biodegradable waste.
Type: problem
Status: Pending
Upvotes: 25
Comments: 0

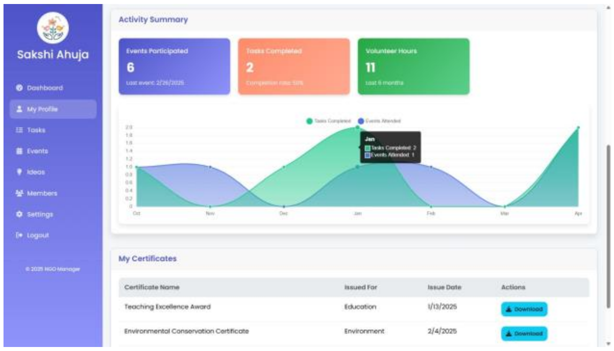
Light for All: Solar Lamp Distribution Drive
By Divija
We should organize a solar lamp distribution drive to provide sustainable lighting solutions to underprivileged households in rural and slum areas. This initiative will help families reduce dependency on kerosene lamps and promote renewable energy awareness. Volunteers should assemble and distribute solar lamps while educating the community about energy conservation and eco-friendly living. This event will not only brighten homes but also empower communities towards a greener future.

Fig. 9. Ideas and Problem Reporting Page



Name	Email	Role	Domains	Joined	Status	Actions
Admin User	admin@example.com	Admin	Marketing Social media Technical	Apr 4, 2025	Active	
Divija	divijajoshi56@gmail.com	Volunteer	Marketing Social media Design	Apr 4, 2025	Active	
Divija	divijajoshi10@gmail.com	Volunteer	Technology Education Event management	Apr 4, 2025	Active	
Divijal	divijajoshi@gmail.com	Volunteer	Marketing Design	Apr 4, 2025	Active	

Fig. 10. Members and Volunteers Page



Certificate Name	Issued For	Issue Date	Actions
Teaching Excellence Award	Education	1/13/2025	Download
Environmental Conservation Certificate	Environment	2/4/2025	Download

Fig. 11. Personalized Activity Summary

These numbers demonstrate the interface that has been put into place, allowing for domain-based filtering, easy task assignment, and real-time statistics for efficient NGO operations.

User comments attested to the interface's ease of use and enhanced task responsibility and visibility.

V. Future Scope

The NGO Management System, while functionally robust, offers several avenues for future enhancement:

- **Mobile Application:** By creating an Android or iOS application, volunteers and members could access the platform increasing accessibility and participation.
- **AI-Powered Analytics:** Predictive analytics for donor behavior, volunteer performance, and resource allocation can be made possible by integrating machine learning algorithms.
- **Multilingual Support:** Supporting regional languages can increase their uptake by grassroots NGOs in various geographical areas.
- **Third-party Integrations:** Social networking networks, calendar APIs, and payment gateway integration can increase outreach, streamline processes, and improve functionality.
- **Audit Logs and Compliance:** Accountability will be enhanced by incorporating thorough activity records and compliance checks, particularly for donor-related transparency.

These enhancements aim to improve scalability, accessibility, and the system's overall utility in real-world NGO operations.

VI. Conclusion

In order to streamline internal operations like job allocation, event management, and domain-specific user roles, this paper presents a secure, modular, and role-based NGO management system. To guarantee use and security, the system combines a strong Node.js backend, PostgreSQL database, JWT-based authentication, and an intuitive UI/UX design. NGO teams' decision-making and coordination are further improved by responsive interfaces and real-time analytics.

User comments and test results show that the system is ready for deployment in a variety of NGO domains. Its adapt- able architecture makes scaling and modification simple. To increase accessibility and outreach, the system can be extended in the future with multilingual interfaces, mobile application compatibility, and AI-driven work recommendations. These improvements have the potential to make it a complete digital solution for NGOs around the globe.

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