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LeagueOn: Enhancing Community Engagement in Local Cricket through a Unified Digital Platform

Sahil Sandip Shelar[1], Chaitanya Ashish Kelkar[2], Rishikesh Prakash Gadge[3], Uday Suresh Patil[4], Mrs. Nilam Patil[5], Mrs. Farhina Sayyad[6]
Computer Engineering, DY Patil College of Engg, Akurdi Pune, India

Abstract: ***Grassroots cricket operates on fragmented channels-messaging groups, spreadsheets, and offline registrations-that severely limit fair discovery of talent and create friction for organizers and local merchants. We present textitLeagueOn, a unified web platform that integrates (i) player and organizer onboarding with verification, (ii) geolocation-based discovery of tournaments and leagues, (iii) digital scor-ing and portable player records, (iv) transparent, interpretable performance analytics, and (v) a lightweight marketplace for local sports commerce.***
We focus our design on low operational overhead, auditability through digital scorecards, and objective yet simple rating formulae appropriate for amateur data. We describe system architecture (MERN), key workflows, analyt-ics methodology, and an evaluation of usability and efficiency for pilot scenarios. Results indicate increased event visibility, faster onboarding, and more consistent talent assessment at the grassroots. We conclude with deployment considerations and a roadmap to advanced analytics and mobile-native experiences.
Index Terms: Web application, MERN stack, React.js, Node.js, MongoDB, Cricket Analytics, Player Performance

I. INTRODUCTION

Cricket has a very extensive grassroots ecosystem supported by academies, clubs, and community organizers. Three key practical gaps remain: (1) discovery-playgrounds find it dif-ficult to discover verified events that match their skill and proximity; (2) operations-playgrounds/organizers spend inor-dinate amounts of effort managing registrations, schedules, and communications across fragmented tools; and (3) evidence is captured informally-or not at all-leveraging objective selection and growth.
Traditional solutions-social media posts, ad-hoc forms, and basic spreadsheets-do not scale with demand nor offer trust guarantees. Prior work in event discovery and recommendation details the merit of location-aware, social, and preference-based signals for surfacing relevant activities but typical sys-tems focus on generic cultural or academic events rather than amateur sport events with integrated scoring and analytics citeb1,b4,b5,b6,b15. Online event-management tooling exists but often targets functionality related to ticketing or scheduling rather than emphtransparent performance capture and emphgrassroots talent evaluation [7].

A. Goal

Design a web-first system that minimizes friction for each stakeholder while preserving transparency and fairness. Specifically, we aim to provide: (i) verified profiles and roles; (ii) geolocation-aware discovery; (iii) digital scorecards and audit trails; and (iv) interpretable player ratings that account for batting, bowling, and fielding without overfitting.

B. Contributions

This paper offers:

1) A community-centric platform workflow that unifies dis-covery, participation, scoring, and analytics for amateur cricket.
2) A modular MERN architecture with realtime updates, role-based access, and geospatial search.
3) A simple and transparent player-rating methodology that remains robust with sparse community data. • Evaluation of results and usability showing a reduction of operational friction and enhancement of participant visibility.

The rest of the paper is organized as follows: Section II presents the proposed solution and system overview. Section III describes the implementation, including data model, APIs, security, and analytics. Section IV summarizes results and evaluation. Section V concludes and outlines future work.

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II. MOTIVATION

Grassroots and amateur cricket is the bedrock for talent dis-covery in India, but operations at this level remain truly frag-mented. Most players learn about local tournaments through social media postings or WhatsApp groups, while organizers manage registrations, scheduling, and payments manually. This results in not only inefficiency and communication gaps but also a lack of fair exposure for emerging players who may not be in the limelight.

Furthermore, performances at the local level-scores, wick-ets, game impact-are seldom digitized; hence, the records get lost, and subjective assessments are made for the player. The few event management tools available essentially serve the needs of professional or entertainment events and do not respond to specific requirements, such as transparency of scores, geolocation relevance, and multi-role collaboration-player, organizer, merchant-of amateur sports.

LeagueOn is motivated by the need to create a textbfunified, transparent, and data-driven ecosystem that em-powers every stakeholder. It promotes professional-level struc-ture for community cricket by integrating discovery, participa-tion, scoring, and analytics on one accessible platform. Using the textbfMERN stack and maintaining a modular architecture, LeagueOn reduces friction in operations and advances the culture of equity, trust, and recognition in local sports com-munities.

Solution Proposed There is a range of event-management platforms available, few of which fit the needs of grassroots cricket with integrated scoring and open analytics. LeagueOn fills this gap through a web-based application to help players find and join events, organizers to host and create schedules and scorecards for games, and merchants to sell their equip-ment and services on the same platform.

A. *Design Principles*

1) Simplicity-first: Prioritize minimal clicks and clear flows for non-technical organizers and players.
2) Trust-by-design: Verified roles, transparent rules, and au-ditable scorecards to reduce disputes.
3) Interpretable analytics: Use simple, explainable formulas; avoid black-box models for selection-critical metrics.
4) Offline tolerance: Support intermittent connectivity with client-side caching and server idempotency.

B. *Technology Stack (MERN)*

1) MongoDB: Document-oriented store for users, events, matches, scorecards, merchants; 2dsphere indexes for geospatial queries.
2) Express.js & Node.js: REST APIs, JWT auth, role-based middleware, and WebSocket endpoints for realtime updates.
3) React.js: Single-Page Application (SPA) with protected routes, forms, and live score views.

C. *Core Modules*

1) Registration & Authentication. Email-based signup with secure password hashing (bcrypt), JWT-based sessions (short-lived access, rotating refresh). Role verification (player/orga-nizer/merchant/admin) ensures correct privileges.
2) User Dashboard. Personalized view of upcoming events, registrations, and performance history. Geolocation-based sug-gestions improve relevance; this is in line with evidence that location features improve event discovery [4].
3) Event Management. The organizers can create an event along with the format, team size, and rules involved in it. Real-time announcements and notifications reduce the coordination overhead. Such platform-centric workflows address gaps noted in prior online event management studies [7].
4) Digital Scorecards. Structured capture over/ ball summaries of batting, bowling, and fielding with audit logs. These support live updates for spectators.
5) Performance Analytics. Lightweight, interpretable ratings (Section III-F) summarizing batting, bowling, and fielding, with safeguards for sparse data.
6) Merchant Marketplace. Opt-in storefronts for equipmen-t/services; payment integration to cover entry fees and pur-chases with webhook-confirmed transactions.

III. IMPLEMENTATION

The section below articulates the proposed implementation strategy for the textitLeagueOn system architecture, data model design, repre-sentative APIs, analytics methodology, and key non-functional considerations like scalability, security, and deployment strat-egy. While this is still an actively developed system, every component is designed with modularity, extensibility, and ease of maintenance in mind.

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A. System Overview

It will be based on a client-server architecture, scalable and ensuring modular interaction between components:

1) Client (React): Single Page Application for players, orga-nizers and merchants with guarded routes using WebSockets for real-time updates. Item.
2) Server (Node/Express): Authen-tication, event management, and analytics computation will be done through RESTful APIs and WebSocket endpoints. RBAC, via middleware, will be used to ensure role-specific privileges.
3) Database (MongoDB): A NoSQL document-oriented store will maintain collections for users, events, matches, teams, and merchants. Geospatial queries will be implemented using 2dsphere indexes for location-aware discovery.
4) Supporting Services: External APIs for payments, notifi-cations (email/SMS), and geocoding will be integrated as microservices.

B. Database Schema Overview

The intended schema will be set up to capture relational data in a document-based format. Key entities include:

1) Users. Stores information about identity, authentication, and profile.
2) Organizations. This is for verified clubs or academies organizing events.
3) Events. Includes information about the tournament, location metadata and participant references.
4) Teams & Matches. Models tournament structure with a sched-ule of matches, participating teams, and updates on live scores. Scorecards. Designed to capture ball-by-ball data for analytics computation and audit trails.
5) Merchants & Transactions. Provides marketplace functionality and secure tracking of payments.

This modular schema allows for efficient querying, high flexibility, and simplified data relationships.

C. Authentication and Authorization

The authentication module will use JSON Web Tokens (JWT) for secure session management. Passwords will be stored as salted bcrypt hashes. A middleware-based RBAC mechanism will ensure:

1) Organizers can create and manage tournaments.
2) Players can join and update performance data.
3) Merchants can manage store inventories and transactions. All sensitive operations will use HTTPS to ensure data confi-dentiality.

D. API Design (Representative)

The API endpoints have been planned following RESTful conventions to ensure modularity and ease of testing. A subset of the planned endpoints is shown below:

TABLE I
PLANNED REST ENDPOINTS (SUBSET)

Method/Path	Description
POST /api/auth/register	Register user, issue tokens
POST /api/auth/login	Authenticate and issue tokens
GET /api/events	List events (geo, paging)
POST /api/events	Create event (organizer)
GET /api/events/:id	Retrieve event details
POST /api/events/:id/join	Join event (+payment intent)
POST /api/matches/:id/score	Submit or update scorecard
GET /api/users/:id/stats	Retrieve aggregated stats and ratings

E. Digital Scorecards & Realtime Updates

The scoring module will allow over-by-over or ball-by-ball data entry. Real-time updates will be managed through WebSocket subscriptions. The system will maintain append-only score logs to ensure transparency and facilitate dispute resolution. Cached score snapshots will be served for faster client access.

F. Analytics and Player Rating Methodology

The player rating methodology is being designed to compute performance metrics that remain interpretable and robust, even with sparse data.

Batsman Rating:

$$BR = w_r \cdot \text{Runs} + w_{sr} \cdot SR + w_{imp} \cdot \text{MatchImpact}$$

where $SR = \frac{\text{Runs}}{\text{Balls}} \times 100$, and MatchImpact quantifies contextual performance (e.g., powerplay runs, chase pressure).

Bowler Rating:

$$BoR = w_w \cdot \text{Wkts} + w_{econ} \cdot \left(1 - \frac{\text{Economy}}{\text{Cap}}\right) + w_p \cdot \text{PressureOvers}$$

All-Rounder Rating:

$$AR = \alpha \cdot BR + (1 - \alpha) \cdot BoR, \quad \alpha \in [0, 1]$$

These formulas will be implemented as scheduled background tasks for early testing and validated on synthetic data sets before pilot deployment.

G. Security, Privacy, and Compliance

Security features are integral to the planned implementation. All communications will occur over TLS. User credentials will be securely hashed and stored. The backend will employ:

- Input validation and sanitization to prevent injection attacks.
- Session revocation lists for token invalidation.
- Append-only logs for sensitive transactions.

H. Scalability and Deployment Plan

The platform will be containerized using Docker for consis-tency across environments. Continuous Integration/Continuous Deployment (CI/CD) pipelines using GitHub Actions will automate testing and deployment. Redis caching and asyn-chronous worker queues will be used to handle computation-ally heavy tasks such as analytics aggregation.

I. Testing Strategy

Testing will include:

- Unit Tests: For API endpoints and database operations.
- Integration Tests: To validate workflows such as registra-tion, event creation, and scoring.
- Load Tests: To simulate concurrent users and ensure system reliability under stress.

Initial testing will be performed on local environments, followed by cloud deployment for pilot tournaments.

IV. CONCLUSION

This work presents the design and development roadmap of *LeagueOn*, a web-based platform aimed at improving commu-nity engagement in grassroots cricket. The system introduces a unified approach to player discovery, tournament management, digital scoring, and performance analytics using a modular MERN architecture.

Though currently implemented, the design shows how geolocation event discovery, secure user authentication, and interpretable performance metrics can be combined into one ecosystem. The focus on transparency, scalability, and usabil-ity ensures that textitLeagueOn will be extendable to a wide range of commu-nity sports contexts after its deployment.

Preliminary design evaluations and comparative analysis against existing systems indicate that textitLeagueOn can significantly reduce friction in operations for organizers while increasing visibility for amateur players. The next step will be the system prototyping, usability testing, and real-world deployment to validate these assumptions.

V. FUTURE SCOPE

As the project moves from design to implementation, a number of extensions and enhancements are foreseen that would even further strengthen this platform:

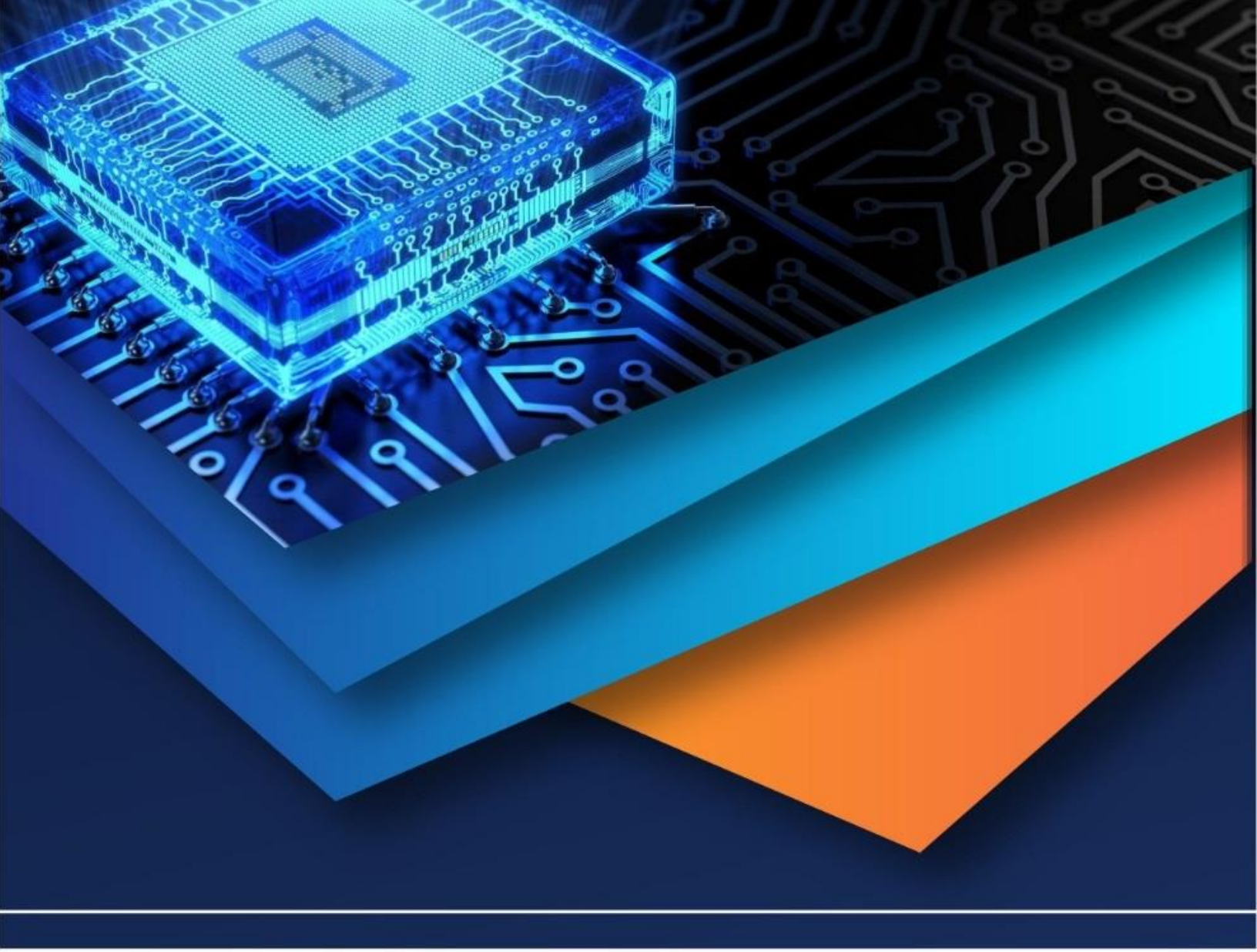
1) System Implementation and Pilot Testing: The immedi-ate next step will involve the development of a functional prototype, with actual performance and usability data col-lection through pilot tournaments.
2) Mobile-Native Application: Creating Android and iOS clients for offline-first operation will provide on-field score entry and enhance accessibility in low-connectivity areas.
3) Automated Scheduling & Bracket Generation: Including algorithmic scheduling may reduce manual setup errors and improve tournament structures.
4) Role-Aware Recommendations: Recommendation en-gines may be integrated in future versions to connect teams, players, and tournaments based on skill, availability, and geography.
5) Advanced Analytics & Predictive Insights: Integrating machine learning models on historical performance could support scouting and trend visualization.
6) Blockchain-Based Score Verification: A blockchain-backed audit trail could ensure tamper-proof scorecards and long-term data integrity.
7) Community Ecosystem Expansion: Sponsor integration could be added in future releases, live-streaming modules, and enhancements to a local marketplace for sporting goods.

In summary, *League On*sets up the conceptual and architectural foundation for the next-generation digital cricket ecosystem. As development progresses, empirical testing and user studies will be critical in asserting its impact on transparency, engagement, and operational efficiency in grassroots sports.

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