Web-Based Information System for Outstanding Athlete Data Management and Regional Sports Performance Reporting

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Abstract

Managing outstanding athlete data is an important requirement for the Youth and Sports Office of Tangerang City because the data are used for Key Performance Indicator (KPI) reporting and as a basis for sports development. The existing process still relies on Excel/PDF files, which creates risks of duplication, delayed updates, limited access, and difficulties in presenting athlete distribution by subdistrict and sport branch. This study aims to design a web-based information system for outstanding athlete data management to support data collection, verification, recapitulation, visualization, and KPI reporting more effectively. The research methods include PIECES analysis, Unified Modeling Language (UML) modeling, database design, implementation using PHP and MariaDB, and black box functional testing. The proposed system provides login, dashboard, athlete data management, sport branch management, area management, article management, user management, data verification, and reporting features. Testing of eight main functions produced valid functional results. The study also identifies operational-readiness requirements for subsequent user acceptance, security, performance, usability, and interoperability evaluation. The system is intended to support more structured athlete data management and KPI reporting at the Youth and Sports Office of Tangerang City.

Keywords: *outstanding athletes; black box testing; KPI; PIECES; web-based information system*

1. INTRODUCTION

Digital transformation in the public sector requires performance data management that is fast, accurate, integrated, and traceable. In the Indonesian government context, the Government Agency Performance Accountability System (SAKIP) places the measurement, collection, classification, summarization, and reporting of performance as an important part of public agency accountability (Presidential Regulation of the Republic of Indonesia Number 29 of 2014). Meanwhile, the Electronic-Based Government System (SPBE) agenda emphasizes the use of information technology to improve service integration, process efficiency, and the quality of government governance (Presidential Regulation of the Republic of Indonesia Number 95 of 2018). Therefore, information system development is not merely a technical need but also part of strengthening accountability and public services. From a management information system perspective, information technology plays a role in integrating data, accelerating information processing, and supporting more directed organizational decision-making (Laudon & Laudon, 2020).

The Youth and Sports Office of Tangerang City has responsibilities in youth and sports affairs. One indicator used to measure the office's performance is the number of outstanding athletes at provincial, national, and international levels. These data are important because they relate to the evaluation of sports development, performance reporting, and the provision of strategic information for leadership. This need is in line with Law Number 11 of 2022 on Sports, which positions sports development, management, rewards, and sports information development as part of national sports governance.

The problem at the Youth and Sports Office of Tangerang City is that outstanding athlete data are still managed using Excel/PDF files. In 2024, Tangerang City hosted POPDA XI and PEPARPEDA VIII of Banten Province, with 821 outstanding athletes recorded, exceeding the target of 300 athletes. However, these data have not yet been managed in a system that enables rapid updates, structured search, and visualization of athlete distribution across 13 subdistricts. This condition makes the recapitulation process dependent on manual data collection from sport branches, KONI, and other supporting documents.

Previous studies show that web-based information systems can help organizations reduce dependence on separate documents and accelerate data processing. Indrayani et al. (2024) developed an athlete data information system for the Youth and Sports Office of West Papua Province to address delays and limited data coverage. Sunarya et al. (2020) used PIECES analysis and UML in designing a web-based information system to improve administrative and reporting effectiveness. Hendriyati et al. (2022) also emphasized that data integration in information systems supports accuracy, transparency, accountability, and information availability for leadership.

Based on these conditions, this study aims to design a web-based information system for outstanding athlete data management to support KPI reporting at the Youth and Sports Office of Tangerang City. The research gap addressed in this study is the limited integration between athlete data management, subdistrict-level visualization, and KPI reporting within a single web-based workflow. The practical contribution is therefore not only the digitization of athlete records but also the provision of structured verification, reporting, visualization, and role-based access features that correspond to the reporting needs of a regional sports agency.

The proposed system positions outstanding athlete data as an organizational information asset by supporting athlete recapitulation, distribution visualization by subdistrict, grouping by sport branch, and coordination among sport branches, KONI, planning units, the office secretary, and leadership. Because the current study evaluates functional behavior through black box testing, claims about operational effectiveness are limited to the tested functions; broader acceptance, security, performance, and usability outcomes require further evaluation.

2. RESEARCH METHODS

This study uses an information system design approach. Information system design should begin with identifying user requirements, analyzing business processes, and preparing system designs so that the developed solution fits organizational needs (Dennis et al., 2021; Kendall & Kendall, 2020). The research object is the outstanding athlete data management process in the Sports Division, particularly the Sports Achievement Development unit of the Youth and Sports Office of Tangerang City. The scope of the system focuses on outstanding athletes who reside in Tangerang City and have achieved results in provincial, national, or international competitions.

System analysis uses the PIECES framework, which covers performance, information, economy, control, efficiency, and service. This framework is used to map weaknesses in the current system and determine improvement directions. System design is conducted using UML, mainly through use case diagrams and activity diagrams. UML is used because it is a standard modeling language for visualizing, specifying, constructing, and documenting software system artifacts (Object Management Group, 2017). UML also helps clarify actor interactions, activity flows, and functional requirements so that the design is easier for developers and users to understand (Narulita et al., 2024).

The system is implemented using PHP and MariaDB. Functional testing is conducted using black box testing to examine system responses to defined inputs and expected outputs. The testing covers login, master data management, outstanding athlete reports, sport branch administrator management, article management, area management, sport branch management, and dashboard functions. In addition to functional validation, the study identifies four areas for subsequent operational-readiness evaluation: user acceptance testing (UAT), basic

security testing, performance testing, and usability evaluation. These additional evaluations are treated as future validation activities because no empirical results for them are reported in the present study.

Table 1. Research stages

Stage	Activity	Output
Problem identification	Observing the data collection process and outstanding athlete reporting documents.	List of current system problems and initial requirements.
Requirement collection	Conducting interviews with Youth and Sports Office stakeholders, sport branches/KONI, and literature study.	User requirements and system scope.
PIECES analysis	Analyzing performance, information, economy, control, efficiency, and service aspects.	Basis for improving business processes and system features.
System design	Developing UML models and database design.	Use case, activity, and database structure.
Implementation and testing	Developing a PHP-MariaDB-based system and conducting black box testing.	System prototype and validation results of main functions.

3. RESULTS AND DISCUSSION

3.1 Current System Analysis

The current workflow begins when the Youth and Sports Office requests outstanding athlete data from the Government of Banten Province, KONI of Tangerang City, and affiliated sport branches. Each party sends data separately. The received data are then recapitulated by the office to fit the report format required by the Regional Development Planning Agency (Bappeda) of Tangerang City and the Ministry of Home Affairs. This process takes time because the data are not received simultaneously, file formats are not always uniform, and validation must be carried out manually.

Based on the PIECES analysis, the main weaknesses of the current system concern access speed, information consistency, user control, recapitulation efficiency, and data service quality. The available Excel/PDF-based workflow makes updating and validation dependent on manual coordination, increases the possibility of duplicate or inconsistent records, and does not directly provide athlete distribution maps or sport branch charts. These findings indicate the need for a web-based information system that can centralize data entry, support verification, simplify recapitulation, and improve information presentation.

Table 2. PIECES analysis of the current and proposed systems

Aspect	Current system	Proposed system
Performance	Data access and reporting are slow because data are distributed across many files.	Centralized web-based storage enables faster search and reporting.
Information	Information is not always up to date, data formats are not uniform, and duplication risk remains high.	Validation, grouping, and structured presentation of athlete data.
Economy	Manual recapitulation requires additional time and effort.	Reduces repeated work through input, edit, delete, save, and report printing features.

Control	Access rights are not managed systematically.	Role-based access management for sport branch/KONI administrators, planning units, secretaries, and leadership.
Efficiency	Data collection and recapitulation are inefficient because data come from many sport branches.	Data coordination is conducted through an online-accessible system.
Service	Data presentation is less informative because maps and charts are not yet available.	Dashboard, distribution map, sport branch charts, and printable reports.

3.2 Comparison with Related Studies

This study is strengthened by several previous studies. The study by Indrayani et al. (2024) is relevant because it also discusses an athlete data information system in a sports agency. The difference is that this study positions outstanding athlete data as strategic data for KPI reporting and subdistrict-level visualization. Sunarya et al. (2020) demonstrated the usefulness of PIECES, UML, PHP, and MySQL in designing web-based systems, whereas this study applies a similar approach to sports data services. Aisyah et al. (2022) also showed that web-based applications can accelerate service management and information presentation, making the study relevant as a basis for strengthening web-based systems in organizational data services. Hendriyati et al. (2022) emphasized the importance of data integration in supporting leadership decision-making, which supports the argument that outstanding athlete data should be managed as an organizational information asset.

Thus, this study is positioned at the intersection of management information systems, digital public services, and performance reporting for a regional government agency. The focus of this study does not stop at application development; it connects the system with performance accountability, decision-making, and sports sector data governance. The position of this study compared with related studies is presented in Table 3.

Table 3. Position of the study compared with related studies

Study	Main focus	Relevance to this study	Difference/contribution of this study
Indrayani et al. (2024)	Athlete data information system at the Youth and Sports Office of West Papua Province.	Emphasizes the importance of digitizing athlete data management in sports agencies.	Highlights outstanding athlete data as a basis for KPI reporting and distribution across 13 subdistricts in Tangerang City.
Sunarya et al. (2020)	Web-based bus rental information system using PIECES, UML, PHP, and MySQL.	Supports the use of PIECES and UML in web-based system design.	Applies the approach to athlete data governance and performance reporting at the Youth and Sports Office.
Aisyah et al. (2022)	Web-based booking service information system.	Shows that web-based systems can accelerate service processes, data recording, data storage, and report presentation.	Applies the web-based system principle to outstanding athlete data management and KPI reporting at the Youth and Sports Office of Tangerang City.
Hendriyati et al. (2022)	Integrated student and lecturer data	Emphasizes data integration for reporting	Adapts data integration principles for athlete,

	management information system.	accuracy and transparency.	sport branch, area, and KPI report data.
Yulianjani et al. (2021)	Web-based student assessment system.	Shows that web systems can accelerate institutional data processing.	Develops non-academic performance data processing for the regional sports sector.

3.3 Proposed System Design

The proposed system changes file-based data collection into a web-based information system. Users with appropriate access rights can log in, input athlete data, update data, delete invalid data, manage sport branches, manage areas, manage articles, and print reports. The workflow also includes data completeness validation before changes are stored and reflected in dashboard and report outputs. From the managerial side, the planning unit can conduct initial verification, while the office secretary and head of office can access data for final validation and reporting needs.

The use case diagram in Figure 1 presents the main system actors, namely Admin/Dispora Staff, Sports Federation/KONI, Dispora Leadership, and external report recipient agencies. The main system functions include login, outstanding athlete data management, master data management, user and access rights management, dashboard monitoring, data verification, and KPI report printing or downloading.

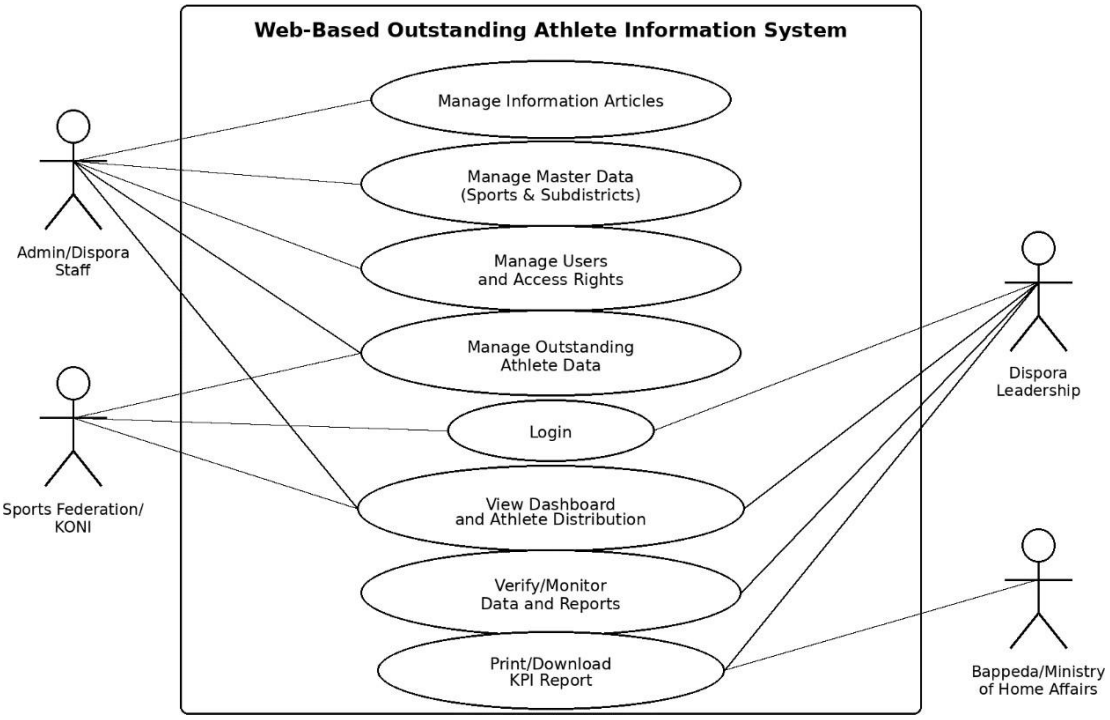


Figure 1. Proposed system use case diagram

The activity diagram in Figure 2 summarizes the main system workflow, starting from login, account validation, athlete data management, data completeness validation, database storage, and dashboard and KPI report updates.

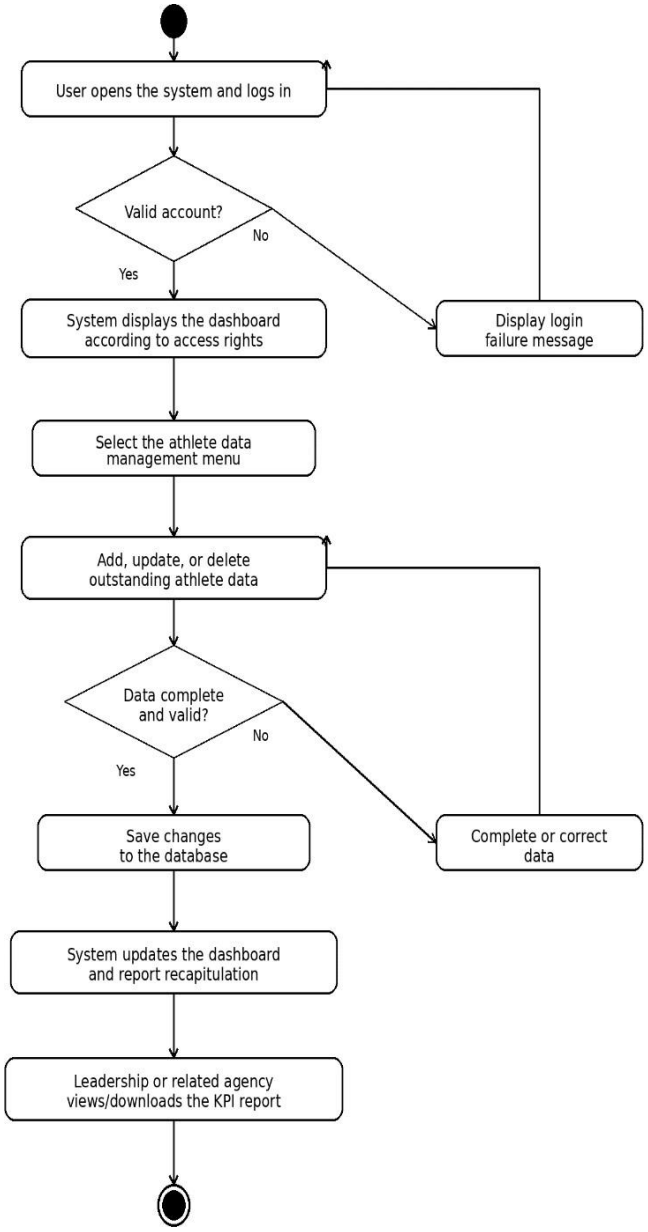


Figure 2. Activity diagram of outstanding athlete data management

The database relationship design in Figure 3 consists of seven main entities: users, roles, role_assignments, athletes, sport_branches, subdistricts, and articles. The athletes entity is the core of the system because it stores athlete identities, achievements, competition levels, years, sport branches, and subdistricts. Relationships with sport_branches and subdistricts allow the system to produce recapitulations by sport and area. The users, roles, and role_assignments entities support authentication and user access rights.

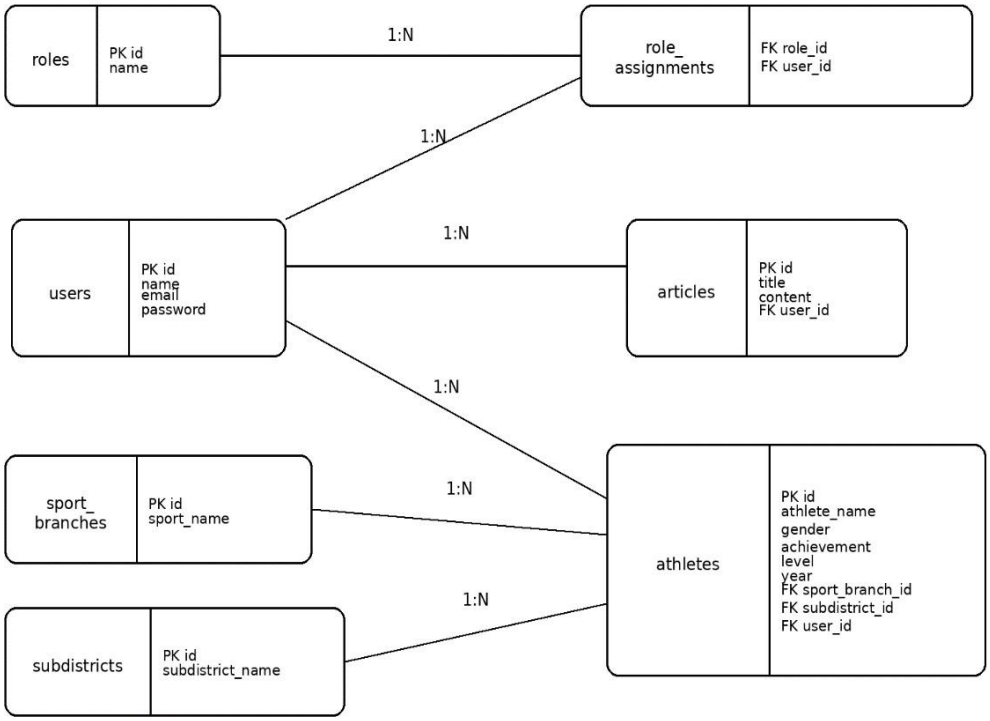


Figure 3. Proposed database relationship design

Based on the system and database design, the comparison between the current and proposed systems is presented in Table 4, while the summary of the proposed database entities is shown in Table 5.

Table 4. Comparison between the current and proposed systems

No.	Current system	Proposed system
1	Outstanding athlete reports use simple Excel/PDF files.	Data are managed through a web-based outstanding athlete information system.
2	Data are displayed in manual columns without area visualization.	The dashboard displays athlete distribution across 13 subdistricts.
3	Outstanding sport branches are shown in manual columns.	Sport branches can be visualized in charts and reports.
4	Data changes require manual editing in files.	Input, edit, delete, save, and report printing are performed through the system.

Table 5. Summary of proposed database entities

Entity	Main function
users	Stores user data, accounts, contacts, and authentication.
roles	Defines user role categories in the system.
role_assignments	Connects users with specific roles.
athletes	Stores core outstanding athlete data, including sport branch, event, achievement, level, and subdistrict.
sport_branches	Stores sport branch data.
subdistricts	Stores subdistrict data for athlete distribution mapping.
articles	Stores information or publication content on the website.

3.4 Interface Design and System Features

The system interface design consists of dashboard, sign-in, athlete data, reports, sport branches, areas, articles, and user management menus. The dashboard functions as a summary page displaying key information, while the athlete data and report menus are used for outstanding athlete data management and recapitulation. The main system interfaces are shown in Figure 4 to Figure 6. Figure 4 shows the system dashboard, Figure 5 presents the athlete data menu, and Figure 6 presents the outstanding athlete report menu.

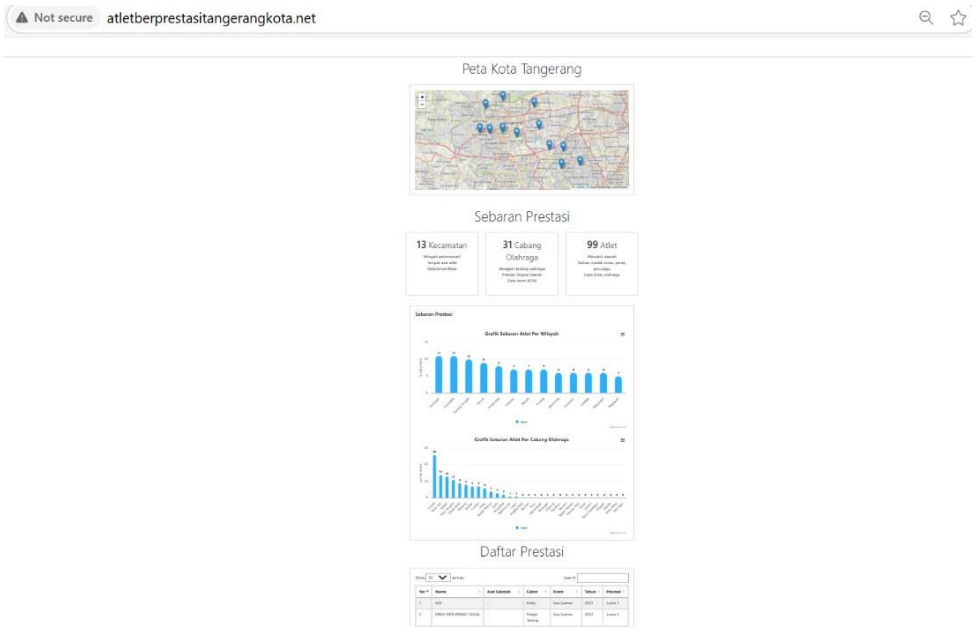


Figure 4. Dashboard of the outstanding athlete information system

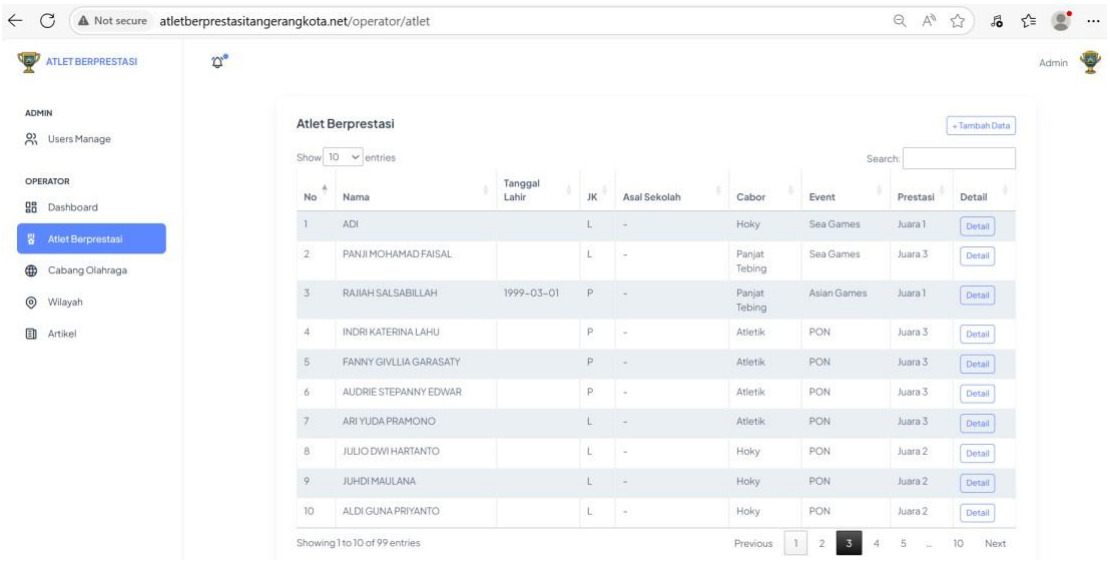


Figure 5. Athlete data menu

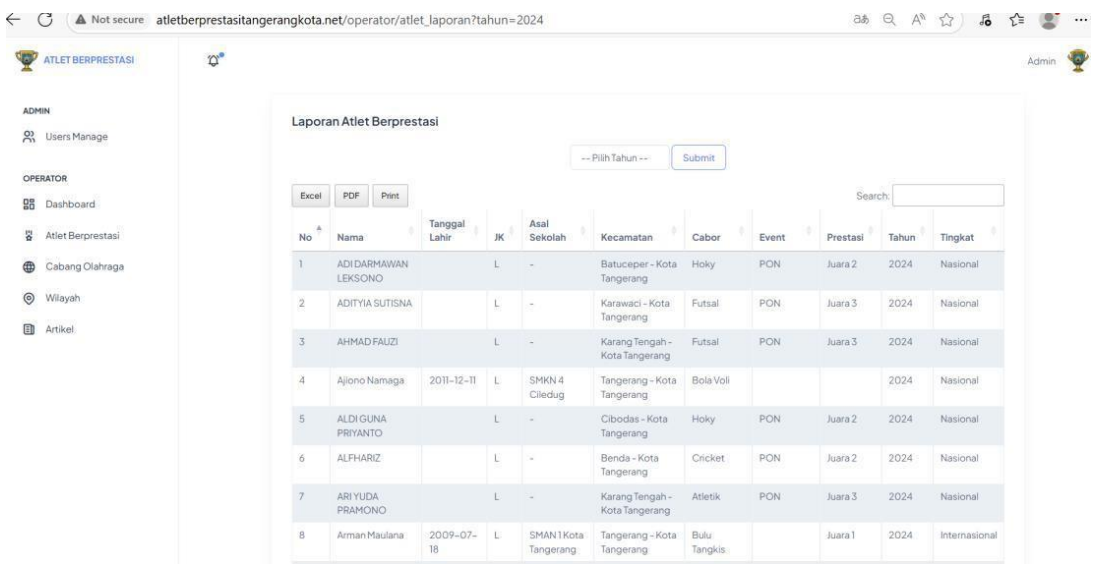


Figure 6. Outstanding athlete report menu

The sport branch and area menus are important because the Youth and Sports Office does not only need to know the number of athletes but also needs to understand the distribution of athletes by sport branch and subdistrict. With these features, the information can be used to identify achievement concentration, regional development needs, and potential priorities for regional sports policy. The user management menu supports access control so that data management can be aligned with user roles.

3.5 System Testing

Testing is conducted using the black box testing method. Eight main functions are tested, namely login, master data, outstanding athlete reports, sport branch administrator management, articles, areas, sport branches, and dashboard. All functions obtain valid results, indicating that the system meets the basic functional requirements that have been designed.

The black box results indicate that the eight tested functions produced the expected functional responses under the defined test scenarios. This supports the conclusion that the prototype satisfies the basic functional requirements represented by the tested features. However, functional validity alone does not establish user acceptance, security adequacy, performance under load, or usability in routine organizational use. Therefore, these dimensions should be evaluated in subsequent stages before the system is considered fully ready for operational deployment.

Table 6. Black box testing results

No.	Tested function	Result
1	Login and incorrect password validation.	Valid
2	Master data management.	Valid
3	Outstanding athlete report.	Valid
4	Sport branch administrator management.	Valid
5	Article management.	Valid
6	Area management.	Valid
7	Sport branch management.	Valid
8	Dashboard display.	Valid

3.6 Implications for KPI Reporting and Data Governance

The web-based outstanding athlete information system is designed to support KPI reporting at the Youth and Sports Office of Tangerang City. First, authorized parties can update athlete data online, reducing dependence on the manual collection of separate files. Second, data can be grouped by subdistrict and sport branch, so the information can describe distribution patterns in addition to total counts. Third, reports can be printed from the system to support administrative reporting needs for Bappeda and the Ministry of Home Affairs.

From a data-governance perspective, the system clarifies roles among sport branches/KONI, the planning unit, the office secretary, and leadership. User-based access rights are intended to reduce the risk of unauthorized data changes, while centralized storage makes records easier to trace and update than separated files. However, audit trails, electronic signatures, and interoperability with regional government systems are not yet implemented in the present study. These features are therefore recommended as subsequent governance enhancements.

The limitations of this study are as follows. First, the system scope is focused on one KPI, namely the number of outstanding athletes, so the findings do not yet represent the full range of performance indicators managed by the Youth and Sports Office. Second, empirical testing is limited to black box functional validation of eight main functions; user acceptance, security, performance, and usability have not been measured. Third, interoperability with regional government systems, audit trails or data change history, electronic signatures, and automated export to specific Bappeda reporting formats have not been implemented. Future research should conduct UAT with representative users, apply measurable usability and performance instruments, perform basic security assessment, develop interoperability mechanisms, and evaluate the system periodically after operational deployment.

4. CONCLUSION

This study produces a web-based outstanding athlete information system to support KPI reporting at the Youth and Sports Office of Tangerang City. The existing Excel/PDF-based workflow has limitations in data updating, search, recapitulation, access control, and athlete distribution visualization. The proposed system provides login, athlete data management, reporting, sport branch and area management, article management, user management, dashboard monitoring, and data verification features. Black box testing of eight main functions produced valid functional results.

The contribution of the system is the integration of athlete data management, distribution visualization, role-based access, and KPI reporting within a single web-based workflow. The findings support the feasibility of the proposed functional design, but broader claims regarding operational effectiveness should be supported by subsequent UAT, security, performance, usability, interoperability, and periodic evaluation. These evaluations are important to ensure that the system remains aligned with organizational reporting and sports development needs.

Based on the findings and limitations, future development should prioritize user acceptance testing with representative stakeholders, basic security assessment, performance and usability evaluation, interoperability with relevant regional government services, audit trails for data changes, electronic signatures where required, analytical dashboards, and export formats aligned with reporting requirements. Periodic evaluation after implementation is also recommended to assess whether the system continues to meet data-management and KPI reporting needs.

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