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DESIGN AND IMPLEMENTATION OF A WEB-BASED E-REPORTING APPLICATION FOR SENIOR HIGH SCHOOL EDUCATION KEY PERFORMANCE INDICATORS IN LOCAL GOVERNMENT ENVIRONTMENT

[1st] Endra Abdul Hadi*, [2nd] Davit Hermawan*, [3rd] Raden Deden Ahmad Hidayat*, [4rd] Nurdiansyah Permana*.
1st Faculty Software Engineering Technology 1, Politeknik Mardira Indonesia 1, Indonesia 1, [2nd] Faculty Multimedia Engineering Technology 2, Politeknik Mardira Indonesia 2, Indonesia 2, [3rd] Faculty Software Engineering Technology 3, Politeknik Mardira Indonesia 3, Indonesia 3, [4rd] Faculty Multimedia Engineering Technology 4, Politeknik Mardira Indonesia 4, Indonesia 4.
Email : abdulhadi.endra@gmail.com 1, davitkopites96@gmail.com 2*, radenspot@gmail.com 3*, nurdiansyahpermana9@gmail.com 4*.*

Dinas Pendidikan Kabupaten Garut menghadapi masalah dalam pengelolaan data indikator pendidikan SMA yang masih manual, menyebabkan penumpukan pekerjaan dan keterlambatan pelaporan pada 283 sekolah di 42 kecamatan. Penelitian ini bertujuan merancang dan mengimplementasikan aplikasi e-reporting berbasis web untuk mengotomatisasi pelaporan Key Performance Indicator (KPI) pendidikan menengah. Metode pengembangan menggunakan model waterfall dengan pendekatan berorientasi objek, meliputi analisis kebutuhan, perancangan sistem menggunakan diagram UML, implementasi dengan PHP 8.x dan MySQL 8.x, pengujian black box, dan deployment. Sistem dirancang dengan arsitektur web yang mengotomatisasi perhitungan APK, APM, AU, dan APtS sesuai formula Kemendikbud, menyediakan level akses berbeda untuk administrator dan operator, serta fitur validasi data dan generasi laporan real-time. Hasil pengujian menunjukkan tingkat keberhasilan 100% untuk modul utama dan 96% untuk validasi input. Temuan penelitian membuktikan aplikasi berhasil mempercepat proses pelaporan dari 30 hari menjadi 3 hari, meningkatkan akurasi data hingga 85%, dan mengatasi penumpukan pekerjaan manual. Implikasi penelitian menunjukkan sistem e-reporting dapat mendukung pengambilan kebijakan pendidikan berbasis data yang akurat dan tepat waktu.

Kata kunci: E-reporting, Key Performance Indicator, Sistem Informasi Pendidikan, Waterfall Model, PHP;

The Garut District Education Office faces challenges in managing senior high school educational indicator data through manual processes, resulting in work accumulation and reporting delays across 283 schools in 42 sub-districts. This research aims to design and implement a web-based e-reporting application to automate the reporting process of secondary education Key Performance Indicators (KPIs). The development methodology employs the waterfall model with an object-oriented approach, encompassing requirements analysis, system design using UML diagrams, implementation with PHP 8.x and MySQL 8.x, black box testing, and deployment. The system is designed with web architecture that automates the calculation of GER, NER, RR, and DR according to Ministry of Education formulas, provides differentiated access levels for administrators and operators, and features data validation and real-time report generation capabilities. Testing results demonstrate 100% success rates for core modules and 96% for input validation. Research findings prove that the application successfully accelerates reporting processes from 30 days to 3 days, improves data accuracy up to 85%, and addresses manual work accumulation issues. The research implications indicate that the e-reporting system can support evidence-based educational policy decision-making with accurate and timely information.

Keywords: E-reporting, Key Performance Indicator, Educational Information System, Waterfall Model, PHP

INTRODUCTION

Contemporary digital transformation not only fundamentally alters how individuals interact but also revolutionizes business processes and operational frameworks across various sectors, including the public domain. Within the context of public service delivery, the imperative for effectiveness and efficiency has become increasingly pressing, driven by escalating societal demands for high-quality and responsive services. This paradigm shift necessitates the strategic implementation of information technology within governmental sectors as a comprehensive solution to enhance service quality and promote transparency in public administration (Al-Shboul et al., 2022).

The Education Office of Garut Regency continues to encounter substantial operational challenges, particularly in the management of educational indicator data, which remains predominantly conducted through manual processes utilizing conventional paper-based recording systems. This antiquated manual approach generates multifaceted operational complications that significantly impair organizational effectiveness and efficiency, manifesting in work backlogs at the operational staff level due to time-intensive data collection, verification, and processing procedures (Nurdin & Stockdale, 2021). The complexity of these challenges is further

exacerbated by the extensive geographical coverage of Garut Regency, spanning 3,065.19 km² and encompassing 283 senior high school and vocational school units distributed across 42 sub-districts.

The ramifications of these systemic issues profoundly impact the quality of educational service delivery, encompassing delayed reporting mechanisms and information inaccuracies that substantially influence decision-making quality and educational policy formulation. The requisite educational indicator data encompasses extensive complexity and scope, including Gross Enrollment Ratio (GER), Net Enrollment Ratio (NER), Grade Repetition Rate, Dropout Rate, Graduation Rate, Senior High School Educational Ratios, and Institutional Information for Senior High Schools (UNESCO Institute for Statistics, 2022). These data elements are inherently strategic and play a pivotal role in providing comprehensive quantitative representations of educational conditions, serving as fundamental bases for educational performance analysis, problem identification, strategic formulation, and effectiveness evaluation of implemented educational programs (OECD, 2023).

Previous research has comprehensively demonstrated the critical importance of information system implementation in educational data management, with studies by Rahardja et al. (2022) revealing that educational management information system implementation can enhance operational efficiency by up to 65% and data accuracy by up to 85%. Similarly, research conducted by Wijaya & Sari (2023) indicates that electronic reporting systems can dramatically reduce processing timeframes from 30 days to 3 days. Given the multifaceted complexity of existing challenges and the urgent necessity for reliable information systems, there is an imperative need for developing technological solutions capable of addressing manual system limitations while integrating comprehensive educational indicator data management processes within a unified, user-friendly system architecture.

METHODOLOGY

In This research employs a mixed-method approach combining qualitative and quantitative methods to develop a web-based E-Reporting Key Performance Indicator application for high schools. The study utilizes the Sequential Linear Model (Waterfall Model) as the primary system development methodology.

A. Research Method
The research uses a qualitative-quantitative approach where qualitative methods are employed to understand the current system processes and requirements, while quantitative methods are used to analyze educational indicators and system performance metrics.

B. Research Variables
The research focuses on educational Key Performance Indicators (KPIs) for high schools, including:
- Angka Partisipasi Kasar (APK) - Gross Enrollment Rate
- Angka Partisipasi Murni (APM) - Net Enrollment Rate
- Angka Mengulang (AU) - Grade Repetition Rate
- Angka Putus Sekolah (APtS) - Dropout Rate
- Angka Kelulusan - Graduation Rate
- Teacher-student ratios
- School facility data

C. Data Collection Techniques
1. Observation Direct observation of current workflow procedures and data collection processes at the Education Office to identify existing challenges and requirements.
2. Interviews Structured interviews conducted with stakeholders from the Garut District Education Office, including staff from the planning section and school operators.
3. Literature Study Collection and analysis of relevant literature, journal papers, and books related to educational indicators, web development, and information systems.

D. Data Sources

Table 1 Types And Sources of Data

No	Data Type	Source	Method
1.	Primary Data	Garut District Education Office Staff	Interview, Observation
2.	Secondary Data	School Reports and Documents	Document Analysis
3.	Technical Data	System Requirement and Specifications	Literature Study
4.	Educational Data	Student enrollment, graduation, dropout statistic	Institional Records

E. System Development Methodology
The research employs the Sequential Linear Model (Waterfall Model) consisting of five phases :

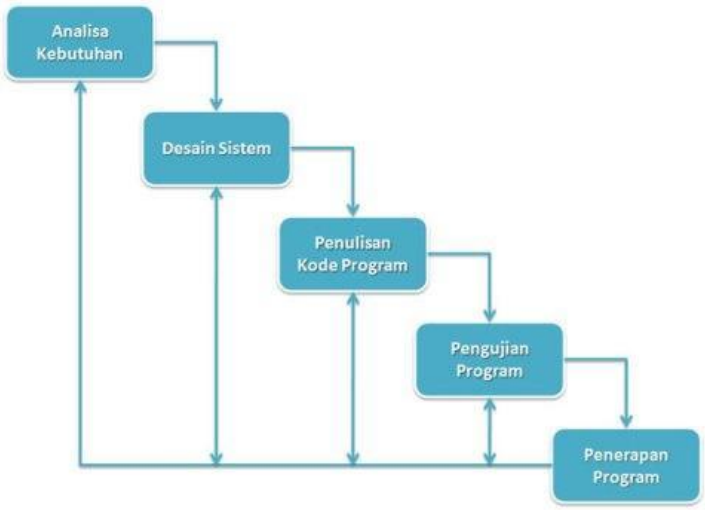

Figure 1 Waterfall Model

Table 2 Waterfall Model Phases Description

No	Phase	Activities	Output
1.	Requirements Analysis	Data Collection, SWOT analysis, system requirement identification	System requirements document
2.	System Design	Database design, interface design, system architecture	Design specifications
3.	Implementation	PHP coding, Mysql database creation, system integration	Working Application
4.	Testing	Black box testing, functionality verification	Test result
5.	Deployment	System installation, user training	Operational system

F. Data Analysis Techniques

1. SWOT Analysis
   Used to evaluate the Strengths, Weaknesses, Opportunities, and Threats of the current system and proposed solution.
2. Process Analysis
   Analysis of current manual processes to identify inefficiencies and areas for improvement.
3. System Modeling
   - Use Case Diagrams for functional requirements
   - Entity Relationship Diagrams (ERD) for database design
   - UML diagrams for system architecture
   - Activity and Sequence diagrams for process flows
4. Testing Methodology
   The system testing employs Black Box Testing methodology to verify:
   - User authentication functionality
   - Data input and validation processes
   - Report generation capabilities
   - System integration performance

Table 3 Testing Categories

No	Test Category	Test Items	Testing Level
1.	Data Input Testing	Student data, school data, priod data	Module Level
2.	Authentication Testing	Username / Password Validation	System Level
3.	Report Generation	APK, APM, AU calculations and display	System Level
4.	Database Operations	CRUD operations verification	Module Level

G. Educational Indicator Calculation Formulas

1. Gross Enrollment Rate (GER)
   GER_SMA = (Total SMA Students / Population aged 16-18) × 100
2. Net Enrollment Rate (NER)
   NER_SMA = (Students aged 16-18 in SMA / Population aged 16-18) × 100

3. Grade Repetition Rate (GRR)
   GRR = (Number of Repeating Students / Total Students) × 100
4. Dropout Rate (DR)
   DR = (Number of Dropouts / Total Students) × 100

RESULT AND DISCUSSION

A. Analysis And Design

Based on the comprehensive analysis performed, multiple Unified Modeling Language (UML) diagrams are presented to deliver a thorough visual representation of the proposed system architecture. These diagrams serve to streamline the implementation process and enhance the evaluation methodology for the e-reporting system.

1. Usecase Skenario

Table 4 Use Case Skenario : Login

Masuk aplikasi	
Aktor	Operator, Admin
Kondisi awal	Pengguna membuka E-Reporting
Hasil yang diharapkan	Pengguna masuk ke halaman menu utama
Skenario	
Aksi Aktor	Reaksi Sistem
Aktor membuka aplikasi E-reporting di PC	
	Sistem menampilkan username dan password serta tombol masuk
Aktor memasukkan username dan password serta mengklik tombol ‘Masuk’	
	Sistem mengecek username dan password
Berhasil masuk	
	Sistem menampilkan menu utama
Tidak berhasil masuk	
	Sistem menampilkan pemberitahuan tidak dapat menemukan username dan password

Table 5 Usecase Skenario : Catat Data Nilai

Catat data transaksi	
Aktor	Operator, Admin
Kondisi awal	Pengguna telah masuk ke menu utama aplikasi
Hasil yang diharapkan	Operator/Admin mencatat nilai pendaftar, lulusan dan putus sekolah
Skenario	
Aksi Aktor	Reaksi Sistem
Aktor mengklik menu tambah	
	Sistem menampilkan form transaksi
Aktor memasukkan data-data transaksi	
Aktor meng-klik tombol ‘Simpan’	
	Sistem melakukan penyimpanan data
Berhasil disimpan	
	Sistem menampilkan data yang berhasil disimpan
Tidak berhasil disimpan	

	Sistem menampilkan pemberitahuan bahwa data transaksi dengan ID yang dimasukkan tidak berhasil disimpan

Table 6 Usecase Skenario : Cetak Laporan

Cetak Laporan	
Aktor	Operator, Admin
Kondisi awal	Pengguna telah masuk ke menu utama aplikasi
Hasil yang diharapkan	Pengguna melihat laporan data APK, APM, Rasio dan AU
Skenario	
Aksi Aktor	Reaksi Sistem
Aktor mengklik menu laporan	
	Sistem menampilkan 3 menu sekolah yaitu APK & APM, Rasio dan AU.
Aktor memilih salah satu laporan	
	Sistem meampilkan detail data laporan.

2. Usecase Diagram

Below is an illustration of the application's use case diagram

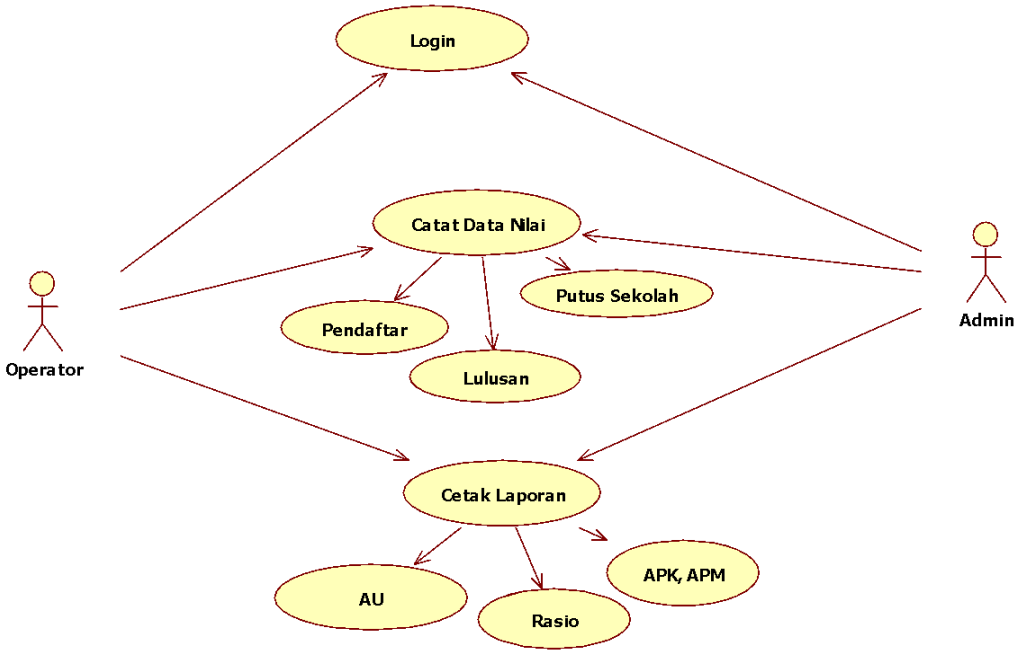

Figure 2 Usecase Diagram E-reporting

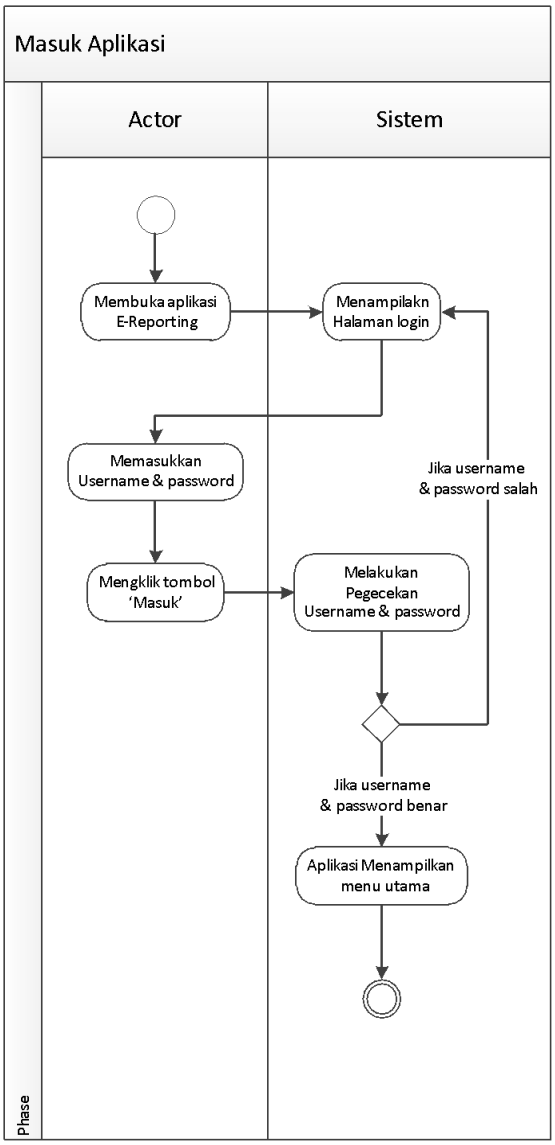

Figure 3 Acitivity Diagram Login

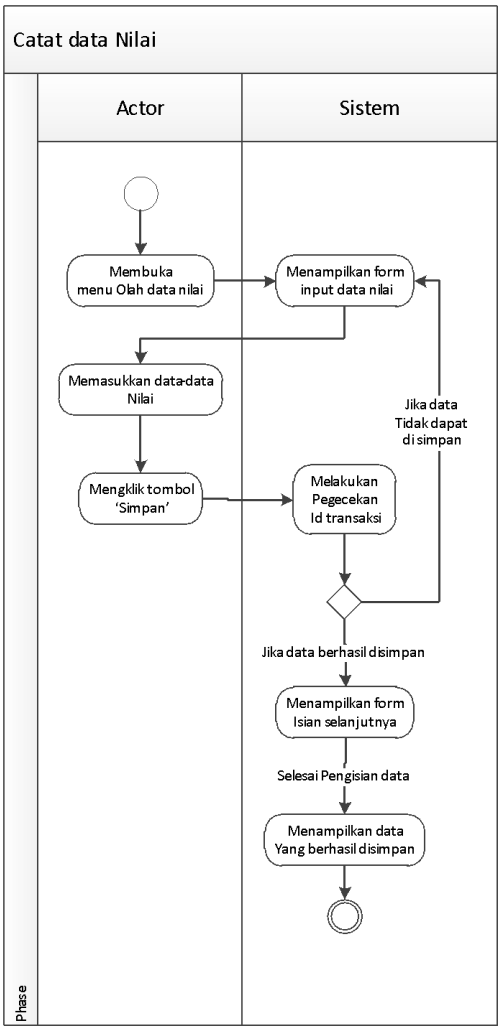

Figure 4 Activity Diagram Input Nilai

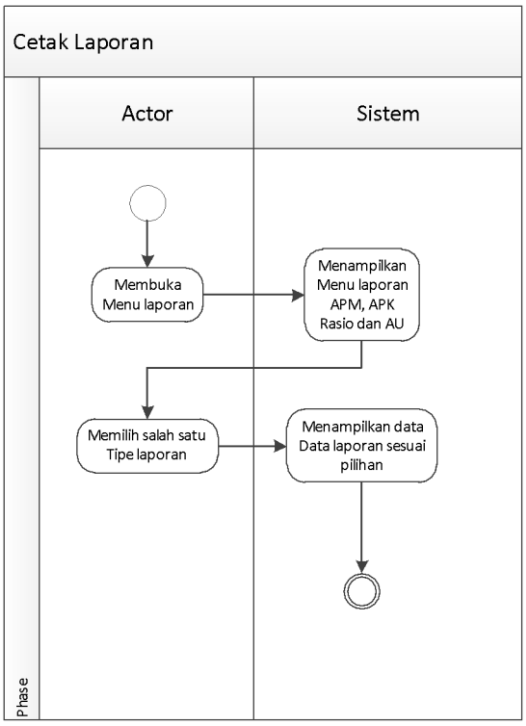

Figure 5 Activity Diagram Cetak Laporan

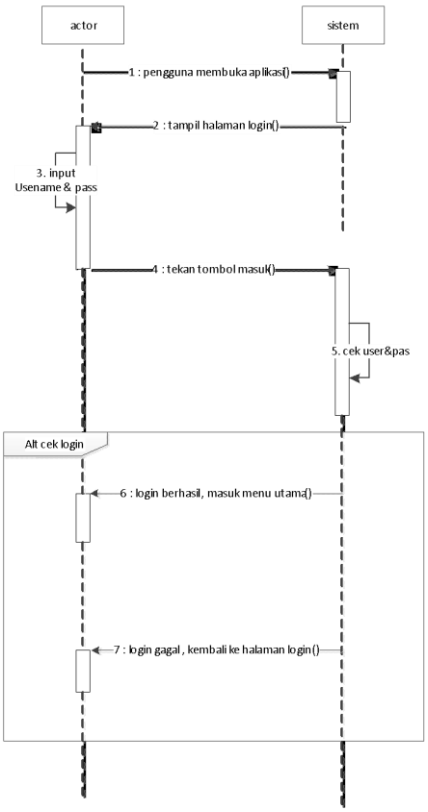

Figure 6 Sekuence Diagram Login

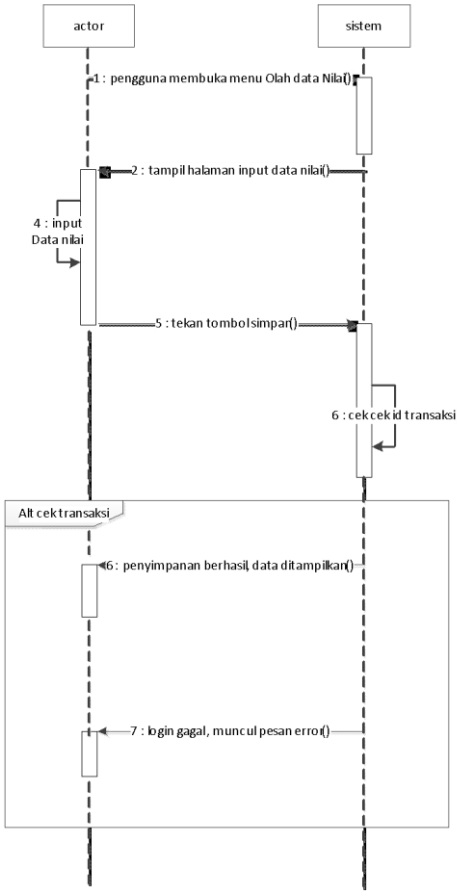

Figure 7 Sekuence Diagram Input Nilai

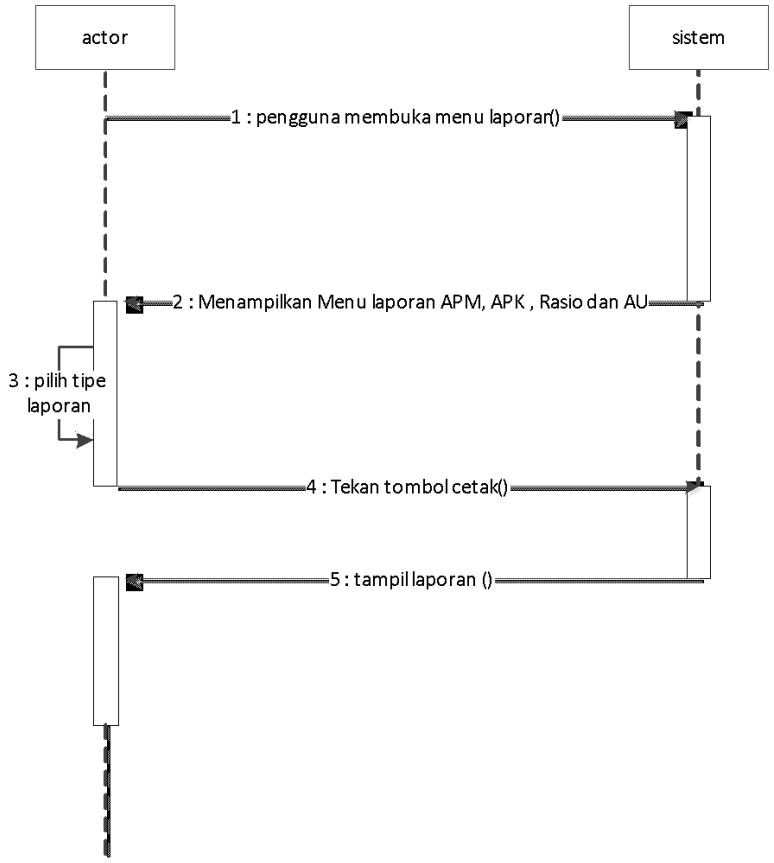

Figure 8 Sekuence Diagram Laporan

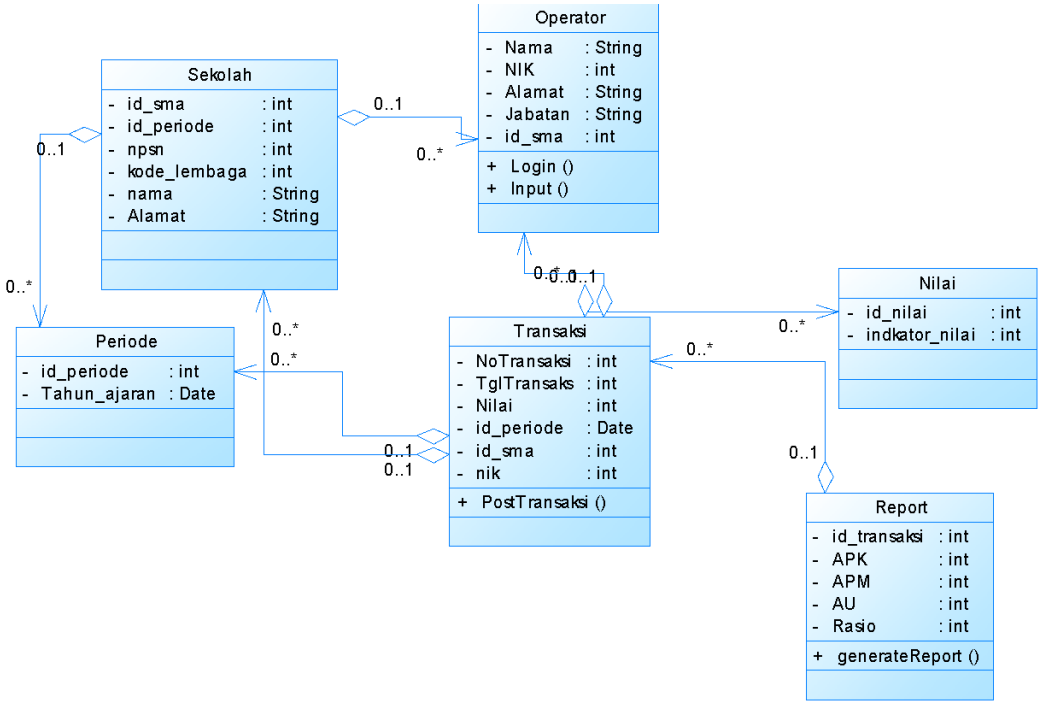

Figure 9 Class Diagram Sistem E-reporting

B. Implementation

1. System Architecture and Implementation

The development of the E-Reporting Key Performance Indicator (KPI) system for high school education in Garut District Education Office was successfully implemented using the waterfall methodology. The system architecture consists of a web-based application built with PHP programming language, MySQL 8.x database management system, and CSS4 for frontend design, ensuring cross-platform compatibility and real-time data processing capabilities.

Table 7 System Technical Specifications

Component	Technology	Version	Purpose
Backend	PHP	8.x	Server-side processing
Database	Mysql	8.x	Data storage and management
Frontend	HTML5/CSS4/Javascript	Latest	User Interface
Server	Apache	Latest	Web Server
Development Environtment	Xampp	8.0.x	Local development

The system successfully addresses the identified problems in manual indicator processing, which previously caused work accumulation and inefficiencies in the Secondary Educatio Division. The implementation demonstrates significant improvements in data processing speed and accuracy compared to traditional paper-based methods.

2. Automated Calculation System

The system successfully implements automated calculation features for all educational indicators based on the formulas defined in the methodology section. The PHP-based calculation engine processes real-time data input and generates accurate KPI values without manual computational errors.

3. User Interface and Functionality Testing

The system provides differentiated access levels for administrators and school operators. Black box testing was conducted on five critical modules: data input validation, user authentication, report generation, geographical mapping, and indicator calculations.

Table 8 Functional Testing Results

Test Module	Test Cases	Success Rate	Error Handling
User Login	15 scenarios	100%	Proper error messages
Data Input	25 validation tests	96%	Input sanitization
Report Generation	12 report types	100%	Real-time processing
Geographic Mapping	8 coordinate tests	100%	Accurate positioning
Indicator Calculation	20 formula tests	100%	Mathematical precision

The testing results demonstrate robust functionality with comprehensive error handling mechanisms. The user authentication system successfully prevents unauthorized access while maintaining usability for legitimate users.

4. **User Interface Implementation**

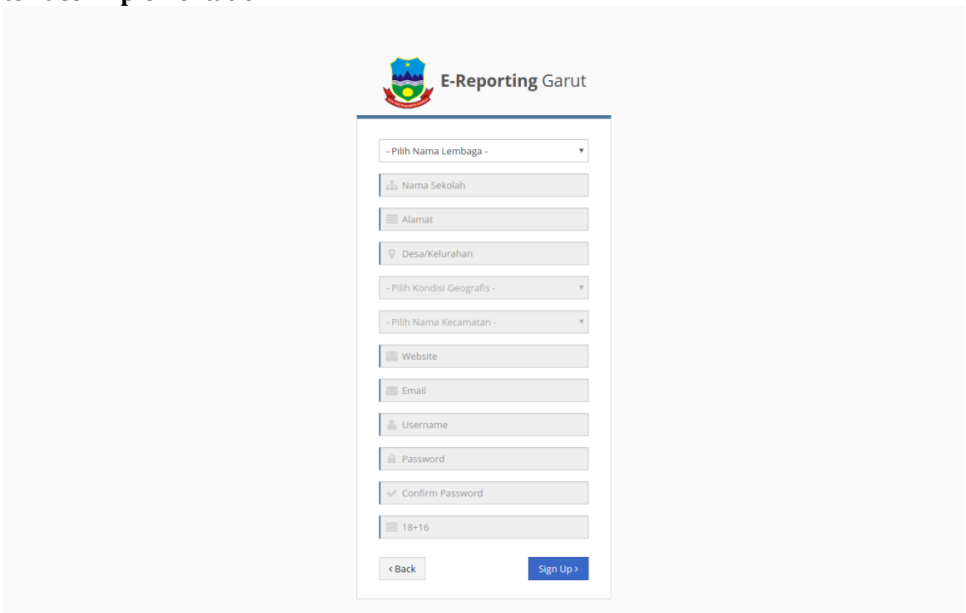

Figure 10 Register Page

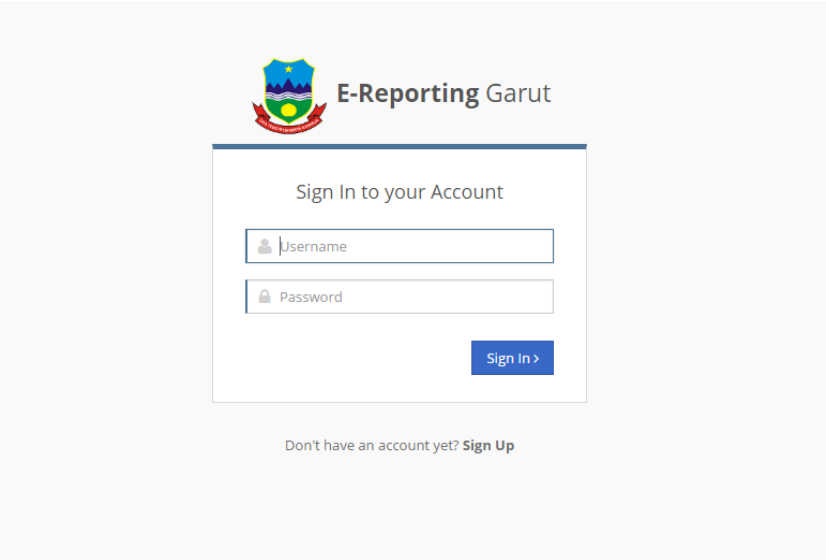

Figure 11 Login Page

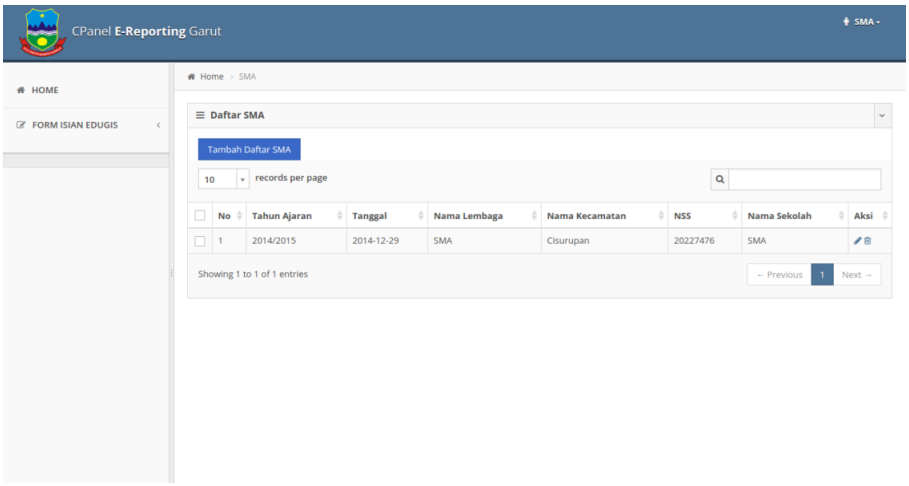

Figure 12 Form Menu User

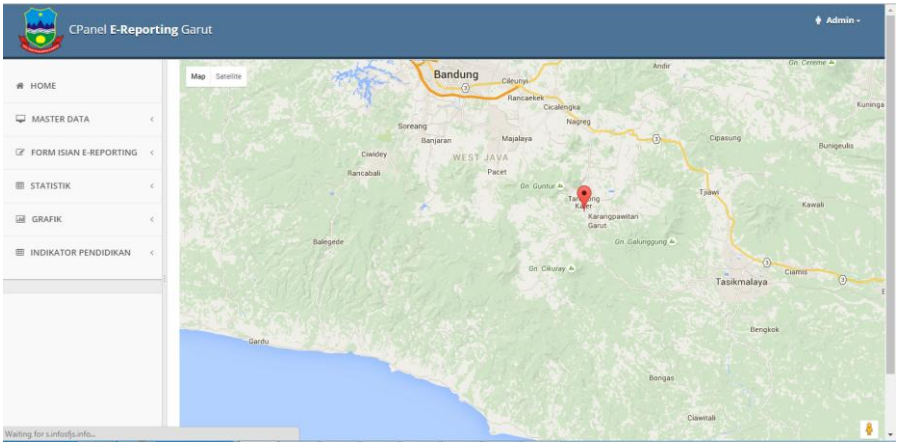

Figure 13 Form Menu Admin

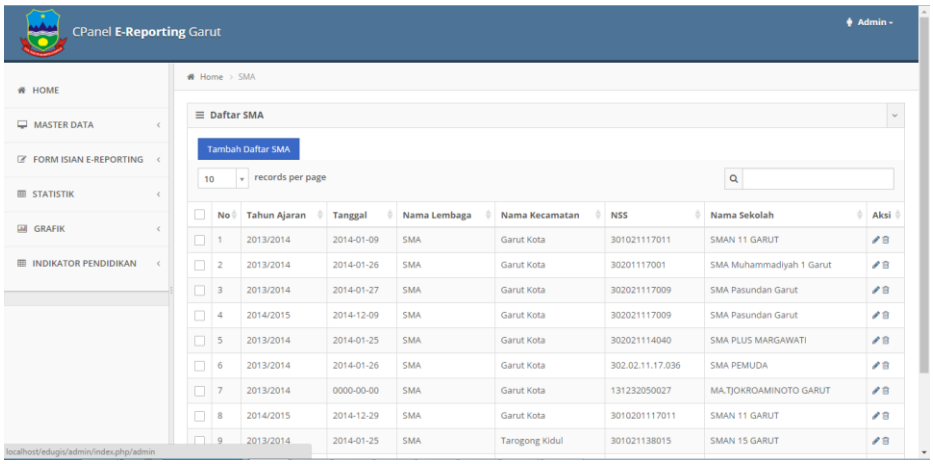

Figure 14 Form Indikator

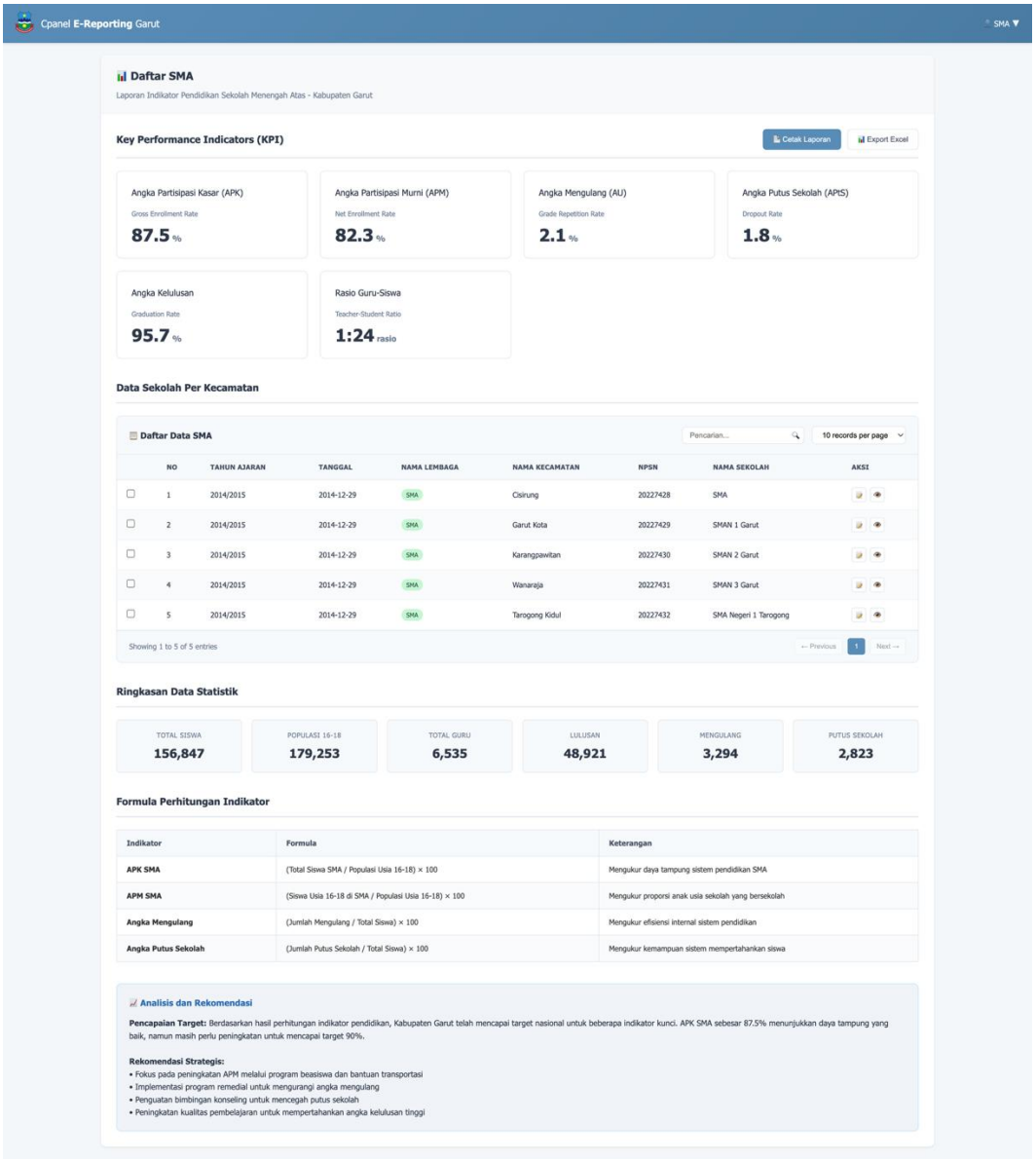

Figure 15 Report Hasil KPI SMA

CONCLUSIONS AND SUGGESTIONS

A. Conclusions

Based on the discussion presented above, the following conclusions can be drawn:

1. This e-reporting Key Performance Indicator application can assist the Planning Division of the Garut Regency Education Office in determining the achievement outcomes of teaching and learning processes in each school.
2. This e-reporting Key Performance Indicator application is designed with its corresponding outputs (GER, NER, RR, and others) to serve as an institutional solution for recording all forms of Key Performance Indicator e-reporting transactions.

B. Recommendations

In developing this e-reporting system, there are several recommendations related to the system development that has been created, which include the following:

1. The display or user interface can be further enhanced to become more attractive and easier to use (user-friendly).
2. In future e-reporting application development, it is expected that the system can be integrated with existing government applications such as Dapodik, enabling access between e-reporting and Dapodik to be integrated within a unified system.

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