AI-driven system for modeling and optimization in IT project management

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Abstract

This paper describes the design and implementation of an AI-driven web platform designed to streamline project management by automating planning, prediction, and resource allocation workflows in IT projects. The research explores essential stages of project setup – from goal formulation and budgeting to scheduling and process modeling, including the distribution of individual tasks. Particular emphasis is placed on applying artificial intelligence methods to improve task assignment and predict time and budget constraints through algorithms such as linear regression, along with the use of the Critical Path Method for determining task priority and sequencing. Significant attention is given to the visualization of project data through Gantt charts, enabling convenient tracking of project progress. The research examines current technologies in project management, demonstrating their practical value in enhancing management efficiency, mitigating risks, and facilitating more accurate planning under limited resources. This work represents a substantial contribution to the study of technologies in IT project management by proposing practical improvements to automation and optimization across all stages of the project life cycle.

Keywords

Intelligent automation, AI-supported project management, task assignment optimization

1. Introduction

The modern technologies we possess today seemed impossible to implement several decades ago, not only due to limited computational capabilities but also because of the lack of necessary tools to explore complex project management challenges. The current trajectory of human development is focused on maximizing the optimization and automation of all possible business processes, particularly in project management.

The rapid technological progress observed across various industries has resulted in the emergence of advanced instruments for planning and executing projects. Among these, the integration of artificial intelligence (AI) into project management remains a relatively underexplored yet highly promising direction that can improve the efficiency of project execution. AI facilitates automated decision-making and outcome prediction through data-driven analysis. Such technology enables the creation of systems that not only support project management activities but also dynamically adjust to evolving circumstances.

Incorporating AI into project management introduces a responsive environment for real-time data processing and report generation covering financial indicators, resource usage, and task scheduling. This enables managers to make more informed strategic decisions based on accurate, continuously updated information. Although AI-enabled project management tools are becoming more common, their development still demands substantial technical knowledge and implementation effort.

As organizations increasingly strive to improve productivity, AI has become a valuable tool in project management, creating new possibilities for process automation and workflow optimization. The growing demand for efficient project management tools highlights the importance of

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developing mobile and web applications that integrate AI to streamline operations. This is particularly relevant for the IT industry, where rapid technological shifts necessitate systems that can quickly adapt and make responsive decisions.

The goal of this research is to design an automated project management platform that applies AI techniques to enhance planning, resource coordination, and task monitoring. The system is intended to provide end users with accessible tools for managing projects efficiently, improving overall team productivity, and reducing task completion times. The work focuses on1 project management within the IT domain, encompassing both task scheduling and progress tracking. The proposed system supports the management of complex projects through data analytics and predictive modeling. It combines web-based technologies with artificial intelligence to form a unified model and software environment for IT project management. The developed approach encompasses algorithms for optimizing resource allocation, predicting project deadlines, and collecting analytical data to evaluate both individual and collective team performance. To fulfill these objectives, the study defines the following research tasks:

- Carry out a structured analysis of existing project management processes.
- Develop the overall architecture for the web-based project management system.
- Design AI modules responsible for forecasting timelines and project progress.
- Create interface prototypes to ensure intuitive user interaction.
- Implement the system's functional modules, database structure, software architecture, and UI layout.
- Prepare comprehensive user documentation for the implemented solution.

The proposed project management model formed the basis for developing a comprehensive software product that leverages artificial intelligence to streamline and optimize management workflows. The resulting system introduces an original architecture designed to automate key project management functions and dynamically adapt to evolving project conditions.

The practical contribution of this work lies in the created software solution, which integrates algorithms, data structures, and predictive models for planning and optimization. The system model is designed to simplify project coordination, promote a more rational use of available resources, and ultimately enhance the overall productivity of project teams.

2. Related Works

The development of artificial intelligence (AI) technologies opens new opportunities for managing IT projects. With the integration of AI, project management has become more efficient, accurate, and transparent than ever before. This study examines the significance of AI in automating project management processes and its impact on transforming approaches to planning, monitoring, and executing projects.

Artificial intelligence technologies are reforming the ways projects are managed. With the use of AI, project management becomes more intuitive and adaptive, providing users with powerful tools for data analysis and decision-making. As AI continues to evolve, further innovations in project management practices can be anticipated, resulting in more efficient and secure project execution. Characteristics of AI Technologies in IT project management:

- Data Analysis: AI can employ algorithms to analyze large volumes of data, identifying patterns and trends that help forecast project timelines and costs.
- Forecasting: Artificial intelligence can anticipate potential risks and issues that may arise during project management, allowing teams to respond proactively to changes.
- Resource Optimization: AI facilitates automated resource allocation by determining optimal strategies for utilizing finances, time, and human resources.

- Process Automation: The use of AI enables the automation of routine tasks, reducing the workload on teams and increasing productivity [1].

Forecasting algorithms and systems using AI in project management:

- Forecasting Models: AI can accurately estimate project completion times and costs using algorithms such as linear regression.
- Critical Path Method Analysis: AI can optimize resource allocation using critical path models to prioritize task execution.
- Visualization Dashboards: Visual tools (for example, Gantt charts) are used to monitor project progress, providing users with an intuitive interface.

Implementing AI in web applications for project management requires the use of specialized libraries and frameworks, such as TensorFlow or Scikit-learn, as well as expertise in software development. It is also essential to consider the system's architectural requirements to ensure the best performance of AI tools.

An intelligent IT project management system typically consists of several key components that interact with each other to ensure effective operation and process optimization:

- Data Collection and Processing Module: This component handles collecting project information, including resources, budget, deadlines, and task status. Data may come from various sources, such as internal databases, external service APIs, or manual user input.
- Data Analysis: Based on the collected information, this module uses AI algorithms to identify patterns, predict deadlines and costs, and detect risks. This may include the use of machine learning models such as linear regression.
- Resource Management Module: This component optimizes the use of project resources, considering availability, cost, and team workload to ensure the highest possible task execution efficiency.
- Data Visualization: To enhance understanding, the visualization module presents the results of data analysis in a user-friendly format (for example, Gantt charts, project timelines). This helps teams and managers better assess project status.
- User Interface (UI): An intuitive user interface enables users to interact with the system easily, input data, view results, and receive recommendations. It is essential that the UI meets user needs and provides a comfortable working experience.

When implementing a project management system as a web application, interface usability and data processing speed are critically important [2]. All system components must be designed for mobile devices to ensure quick response to user requests and maintain high performance.

Analyzing the web technology market reveals a growing interest in interactive, dynamic, and adaptive layout websites. With the emergence of technologies like AI, web capabilities are expanding, enabling more personalized user experiences. AI can be used to analyze user behavior, allowing the creation of content and services that best meet the needs of the target audience.

Websites integrated with AI technologies offer numerous benefits, including:

- Process Automation: AI can automate request handling, content personalization, and recommendation generation, improving website efficiency.
- Data Analysis: AI can analyze large volumes of data to detect trends and patterns, helping support data-driven decision-making.

The successful implementation of a web-based project management platform requires thorough market analysis, an understanding of the target audience's needs, and the integration of modern

technologies. Investing in the development of AI-powered websites is a crucial step toward creating competitive products that can meet users' increasingly high expectations.

When developing an intelligent project management system, it is essential to select technologies that not only ensure core functionality but also facilitate the effective use of AI for process automation, forecasting, and resource management.

Key technologies include HTML/CSS/JavaScript, React, Django, Flask, and Node.js.

When choosing technologies for web development, it is essential to consider:

- Visualization of progress – ability to clearly display task and project statuses.
- AI integration – smooth support for forecasting and optimization processes.
- Scalability and flexibility – the capability to manage large data volumes.

The combination of HTML, CSS, JavaScript, and modern frameworks, such as React and Django, provides a practical toolkit for developing AI-enabled IT project management systems.

Benefits of these technologies [3]:

- Scalability: The component-based architecture in React allows easy scaling of the project with new features.
- Cross-platform Compatibility: HTML, CSS, and JavaScript ensure the application works across all modern devices and browsers.
- Ease of Development: Libraries and frameworks such as React support structured, team-friendly development.

Selecting the proper technologies for developing a web application for IT project management is a crucial and critical stage. The use of HTML, CSS, JavaScript, and React enables the creation of an efficient, interactive, and scalable product that meets the demands of the modern market.

Choosing the right database technology is a key step in developing a project management system. This choice depends on several factors, such as project requirements, data structure, performance, and ease of use. If the data is relational and structured, it is advisable to use a relational database such as SQLite. For simpler key-value type data, NoSQL databases such as Realm or Firebase Realtime Database are more suitable.

If the data has a clear structure and relationships between entities, a relational database like Room (built on top of SQLite) is recommended. For more flexible data models, such as those based on JSON, Realm, or Firebase is preferred.

The frequency and nature of read/write operations must be taken into account. Some databases, such as Firebase, are fine-tuned for fast data access. Ensure the database supports indexing for efficient querying and is well integrated with the Android Framework.

If the application needs to function offline, it is essential to choose a database that supports local storage, such as Room or Realm.

Ease of integration and the availability of comprehensive documentation can significantly influence the choice. Firebase and Room are well-documented and supported by developer communities, which facilitates the development process.

The database must support encryption features to protect sensitive data, particularly if the system handles confidential information.

Evaluating the costs of using the database, especially in cloud-based solutions, is an essential factor in technology selection [4].

After a thorough analysis of these factors, the most appropriate database for the project management system can be selected. Considering the system has a limited number of entities with minimal dependencies, Room and Realm are ideal choices for this purpose. The database selection, along with the implementation of data access classes, will be overseen in a separate module to ensure a clear and organized architectural structure. This approach will enable the creation of a single class per entity, providing centralized access to data.

Selecting the appropriate development environment and programming language is essential when developing a web application for IT project management. Two of the most popular tools for web application development are Visual Studio Code and WebStorm, both of which offer user-friendly interfaces and powerful coding features.

Visual Studio Code advantages: ease of use, customization for specific project needs, and an active developer community.

WebStorm's advantages include built-in debugging and testing tools, as well as support for frameworks such as React, Angular, and Vue.js.

JavaScript and TypeScript offer the necessary capabilities to create an interactive and dynamic interface. Using HTML and CSS to structure and style the web application ensures a comfortable user experience.

Let's examine the key technologies and methods required for developing an intelligent project management system utilizing artificial intelligence (AI) [5].

Machine learning frameworks and libraries:

- TensorFlow: This framework, developed by Google, provides powerful tools for building and training neural networks. TensorFlow supports various machine learning models and has a broad ecosystem for developing AI solutions.
- Scikit-learn: A Python library for machine learning that offers a practical and straightforward toolkit for data analysis and modeling, including classification, regression, and clustering algorithms.

Methods and algorithms:

- Data analysis: The use of statistical analysis and data visualization methods to gain valuable insights from project data. This may include correlation analysis, time series analysis, and more.
- Forecasting: The use of machine learning algorithms such as gradient boosting or recurrent neural networks (RNN) to predict project deadlines and assess risks based on historical data.

APIs and services for AI integration:

- OpenAI API: This API provides access to powerful AI models that can automate tasks such as text generation, data-based forecasting, and natural language analysis.
- Microsoft Azure AI: The platform offers a wide range of AI services that can be integrated into the system to perform tasks related to natural language processing, computer vision, and data analysis.

The choice of technologies for implementing an intelligent project management system is critical. Integrating frameworks such as TensorFlow and Scikit-learn, along with powerful APIs like the OpenAI API, will enable the creation of an innovative system capable of automating processes, improving decision-making, and adapting to changes in the project environment.

Choosing technologies for developing a web application for IT project management is a crucial and critical step. The use of HTML, CSS, JavaScript, and React allows for the creation of a practical, interactive, and scalable product that meets modern market demands.

Selecting the right database technology is also crucial in developing a project management system. This decision depends on several factors, such as project requirements, data structure, performance, and ease of use.

3. System Architecture, Mathematical Models, and Methods

The architecture of the IT project management system is based on modern web development technologies and the integration of artificial intelligence for automating planning processes, task management, and forecasting timelines and progress. The components described below provide a functional and modular system structure, which simplifies its development and scalability.

The intelligent IT project management system consists of several key modules:

- Project Creation Module: This module provides functionality for creating and configuring projects, including entering the project name, description, objectives, budget, human resources, and deadlines. It utilizes Django for the backend and React for the frontend, ensuring an interactive user interface.
- Task Management Module: This module divides the project into individual tasks. Each task has parameters: title, description, deadlines, and status (planned, in progress, canceled, under review, completed). A Gantt chart is used for visualizing progress, integrated via JavaScript libraries (for example, D3.js).
- Data Collection and Processing Module: This module is responsible for collecting and processing data on resources (quantity, types, workload, efficiency) and financial expenses. Machine learning algorithms based on TensorFlow and Scikit-learn are used for analysis and further forecasting.
- Forecasting and Optimization Module: This module applies linear regression to predict task deadlines and costs. The Critical Path Method is used for resource optimization, enabling the identification of the most critical tasks for successful project completion.

The system architecture is implemented in three tiers:

- Presentation Layer (Frontend): React.js was chosen to develop a dynamic user interface due to its flexibility and fast component rendering capabilities. The main goal of this layer is to provide users with a convenient tool for real-time interaction with projects and tasks.
- Dynamic Forms for Project Creation and Editing: Users can easily create a new project by entering information such as name, description, goal, resources, deadlines, and budget. Validation tools are implemented to ensure data accuracy and avoid errors in inputting critical information.
- Interactive Dashboards: The interface allows tracking of the status of each project and task through interactive panels. These include components such as Gantt charts and progress graphs, highlighting potential issues and optimal completion times, implemented using D3.js or Chart.js libraries. Users can visually monitor the progress, completion, or delays of each task in real-time.
- Responsiveness: The interface is designed with adaptive layout in mind, ensuring comfortable use on both desktop and mobile devices. React.js components utilize the principle of component reusability, enabling easy system scaling and the addition of new features.
- Logical Layer (Backend): This layer implements business logic using the Django framework, which combines fast development speed with reliability for web applications. Django handles interaction between users and the database, managing processes such as planning, forecasting, and resource optimization.
- Frontend Request Processing: All information entered by users via React is sent to the backend through a REST API implemented using the Django Rest Framework (DRF). This enables flexible and rapid handling of requests to create projects, modify tasks, and retrieve forecasts and analytics. The backend also processes requests to predict task deadlines and expenses using AI modules.

- Artificial Intelligence Integration: The backend integrates AI models based on TensorFlow and Scikit-learn. These models use historical project data to forecast potential delays or budget overruns. For instance, a linear regression model based on past projects predicts future task durations and costs. For more complex predictions, a Random Forest model is employed, enabling the accurate projection of potential project developments that consider factors such as resource allocation, task statuses, and risks.
- Resource Optimization: Resource optimization algorithms based on the Critical Path Method have been implemented. This enables the identification of key tasks that affect the overall project duration and facilitates efficient resource allocation to those tasks [6]. The backend continuously updates and optimizes resource distribution based on new data, such as completed tasks or changes in available resources.
- Data Storage Layer (Database): A relational database, PostgreSQL, stores data, providing reliability and scalability for handling large volumes of project, task, resource, and financial information.
- Data Organization: The database structure is designed so that information about projects, tasks, resources, and forecasting results is stored in separate tables. Each project is linked to a set of functions via a foreign key. The task table stores information about deadlines, resources, and task statuses.
- Interaction with Business Logic: SQL queries via Django ORM are used to retrieve and update data. This ensures fast access to current project and task statuses and allows the system to be scaled by adding new features. The database also stores the results of forecasts and resource optimization, which are then visualized on the frontend.
- AI Integration with the Database: AI models, located on the backend, access data from the database for training and prediction, and write their results back into the database. For example, when a new task is added or a project is modified, the models review this data and automatically update their forecasts, saving the results in the appropriate database tables for further visualization and decision-making.

The system's architecture (Fig. 1) is structured to support the efficient management of IT projects through the integration of artificial intelligence technologies. The core component is the React.js framework, which powers the user interface layer. It allows the development of dynamic, responsive web pages for managing projects, visualizing tasks, monitoring progress, and displaying analytical elements such as Gantt charts and cost diagrams [7].

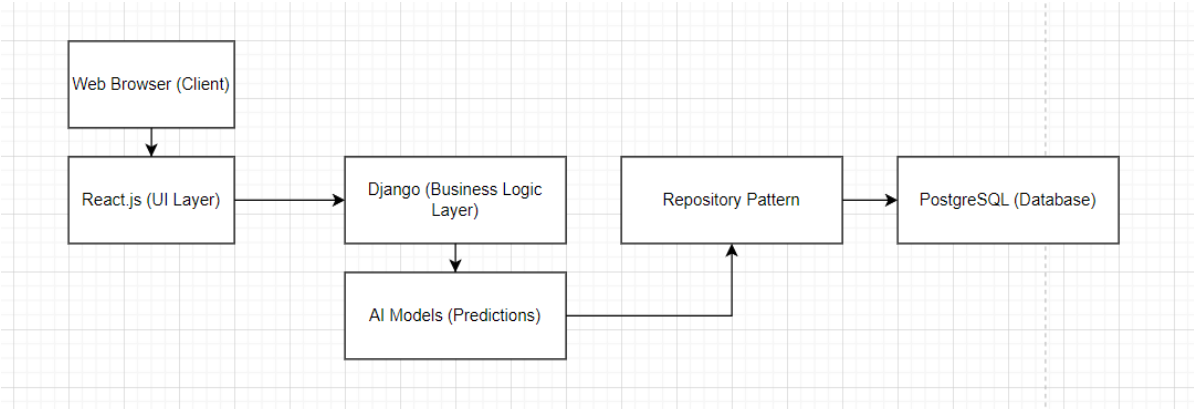

Figure 1: Architecture of mobile application.

On the server side, Django provides the application's business logic (Business Logic Layer). This includes data processing, project and task management, and the implementation of artificial intelligence (AI) models. The AI models perform key functions, such as predicting task completion

timelines and optimizing resource allocation, using linear regression, Random Forest, and the Critical Path Method.

The Repository Pattern, which handles interaction with the database (Domain Layer), enables convenient and flexible manipulation of project data, including information about tasks, resources, and budgets. PostgreSQL is used to store this data, providing a reliable and scalable database solution that ensures the preservation of important project information.

Such an architecture provides flexibility, scalability, and ease of adaptation to new requirements, which are critical for successful IT project management in a dynamic environment.

In the intelligent IT project management system, mathematical models and algorithms play a key role in ensuring the efficiency of project creation, task management, and forecasting processes. The following are the main algorithms that can be implemented within the system:

1. Project Creation includes entering basic parameters such as title, description, budget, and resources. The user inputs data, and the system performs an automatic budget estimation based on the specified resources. Potential risks that may affect the project are identified and analyzed. All information is stored in the database for further management.

2. Task Management allows for creating, editing, and deleting tasks within a project. The user can add functions with parameters (title, description, deadlines, status). The system implements real-time status updates, enabling progress tracking throughout the project execution.

3. Progress and Time Forecasting uses artificial intelligence to estimate the remaining time until project completion and assess team progress. The system collects task execution data and analyzes it using linear regression to assess the relationship between the time spent and the progress made. A Random Forest model is employed for more accurate forecasting of project completion times based on current task status and available resources. Progress reports are generated, allowing teams to view project status and potential delays.

4. Issue Detection involves monitoring project execution and identifying problems. AI is used to detect anomalies in data (for example, task execution delays) based on historical data. The system generates alerts about potential issues that may impact project completion.

5. Project Deletion involves removing a project and its associated data. The user initiates project deletion, and the system checks whether any associated tasks or resources are still active. After confirmation, the system deletes all project-related data from the database.

Use of AI in the System. All the listed algorithms integrate elements of artificial intelligence to automate and enhance project management processes. AI is utilized for data analysis, outcome forecasting, and issue detection, thereby enhancing planning accuracy and resource utilization efficiency. The system implements advanced mathematical models, optimization methods, and machine learning algorithms that automate project management and enhance project success in a dynamic environment.

4. Design and Development of the Intelligent System

The architecture of the intelligent system for modeling and optimizing IT project management employs the classical MVVM (Model-View-ViewModel) pattern, which ensures a clear separation between the user interface and business logic, as well as modularity and ease of maintenance. The development of modules and interaction between system components is based on modern architectural patterns, including SOLID principles and Clean Architecture, which contribute to the solution's structural integrity and stability.

The system consists of several key components:

- Project Creation Module enables the input of core project information, including its name, objectives, budget, resources, and deadlines.
- The Task Management Module allows for the creation and tracking of project tasks with additional parameters such as completion status [8].
- Data Collection and Processing Module handles data collection and processing related to resource usage, budget, and other project parameters, providing reliable analytics for further forecasting.
- Forecasting and Optimization Module is responsible for predicting project completion timelines and resource allocation using machine learning methods, such as linear regression for forecasting and the Critical Path Method for resource optimization.

To ensure flexibility and scalability, the system is built using a web-based architecture that includes a server-side component (Django) and a client-side component (React). This allows for the smooth integration of new functional modules, optimization of existing ones, and streamlined updates.

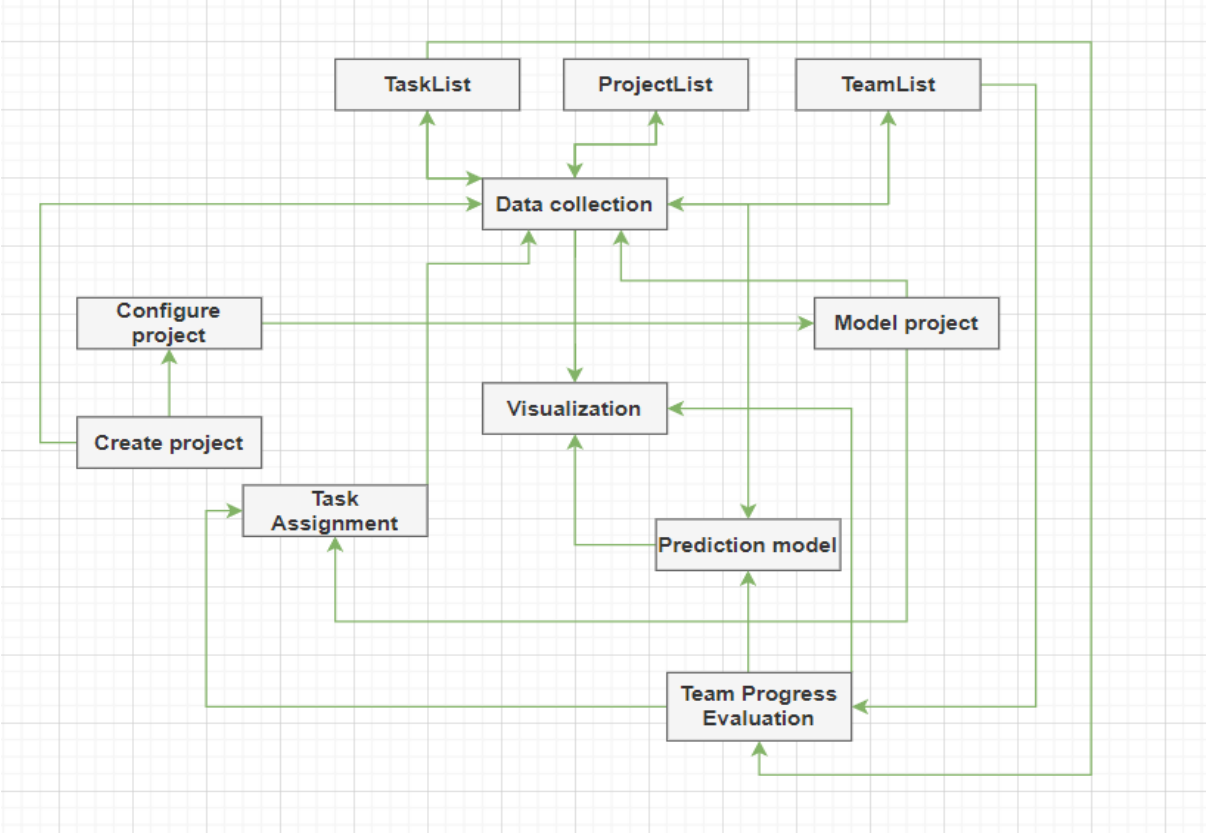

Figure 2: Component diagram of the system.

The component diagram is a type of structural design diagram that illustrates the interaction and dependencies between components of the project management system. It serves to visualize the system's architecture and the relationships among its individual components, each of which plays a specific role in managing IT projects with the support of artificial intelligence. The main components are depicted as blocks, with arrows indicating data flows or dependencies between them (Fig. 2).

The diagram outlines the primary classes that constitute the system's architecture. The relationships between components indicate the dependency of one class on another and include a set of interfaces with shared methods used across different courses. Specific components, such as ProjectList, TaskList, and TeamList, act as containers for storing data about projects, tasks, and teams. These serve as Data Transfer Objects (DTOs) in communication with the database, as well as during data processing and presentation in the user interface.

Other components, such as Create Project, Configure Project, and Task Assignment, are responsible for project setup and resource/task distribution within the team. Components such as the Prediction Model and the Team Progress Evaluation are part of the AI module, which forecasts project timing and budget metrics and evaluates team performance, enabling task adjustments based on the results. Finally, the Visualization component is used to present the collected data, helping users analyze the current project state and make informed decisions [9].

In implementing the IT project management system powered by artificial intelligence, several third-party libraries and modules were integrated to significantly simplify the development process and enhance the application's overall performance.

One of the key libraries used is React, which facilitates the development of interactive user interfaces [10]. It enables component-based architecture that promotes code reusability and simplifies state management. The use of React ensures a dynamic interface, making it easier to introduce changes and resulting in a more flexible development process.

Django was selected for backend operations and request handling. This Python-based framework provides developers with powerful tools for working with databases and implementing RESTful APIs. Django enables rapid and secure request processing, which is essential for a project management system that may handle large volumes of data.

TensorFlow and Scikit-learn were employed to implement machine learning algorithms and forecasting capabilities. TensorFlow is well-suited for implementing complex models such as neural networks, while Scikit-learn offers access to standard data analysis methods, including linear regression. These tools enable accurate estimation of project timelines and efficient resource allocation.

For enhanced data visualization, Chart.js and D3.js libraries were integrated. These tools enable the generation of various charts and diagrams, facilitating a deeper understanding of project progress and financial metrics for users.

PostgreSQL was chosen as the relational database for data storage. It provides reliable and high-performance storage for information related to projects, tasks, and teams, while also supporting complex queries needed for analytics.

Thanks to these libraries and modules, the AI-driven IT project management system was implemented efficiently and designed with user convenience in mind [11].

During testing, a series of comprehensive trials was conducted to identify potential bugs, assess system stability, and evaluate the usability of core functionalities. The test covered key aspects of user interaction, including navigation, project creation, and subsequent workflow management.

In addition to standard functional testing, detailed stability and performance testing of the IT project management system were conducted. The primary objective of these tests was to identify potential issues under high-load conditions and to verify the system’s capability to handle numerous simultaneous requests. To this end, the creation of multiple projects in succession was simulated, along with various operations on existing projects, including editing, deletion, and modeling. Throughout the testing process, system failures, slowdowns, and errors that might occur during intensive usage were closely monitored.

Furthermore, the system’s behavior was tested in scenarios where multiple users performed actions on projects concurrently. Test cases included simultaneous execution of project creation, editing, and deletion operations to evaluate the system’s efficiency in handling parallel requests. A key goal was to ensure that the system remains stable and reliable under significant load, with all database changes processed correctly and without any data loss.

Performance testing was also carried out on various devices, including desktop computers, laptops, tablets, and mobile phones. The interface loading speed, system response time, and smoothness of the user interface were assessed across different screen resolutions. Special attention was given to verifying compatibility with major web browsers, including Google Chrome, Mozilla Firefox, Safari, and Microsoft Edge. This ensured the system is cross-platform and delivers a consistent user experience across different environments and devices.

Interface adaptability testing involved verifying the correct display of elements on screens of various sizes and ensuring the proper functioning of interactive components, such as buttons, forms, and dropdown menus. It was confirmed that the system maintains full functionality when the screen size changes or the device is rotated, and that all key interface elements remain accessible to the user.

Additionally, the system's efficiency in handling large volumes of data was evaluated. This included scenarios where the database contains a substantial number of projects, tasks, and users. It was verified that no significant delays occur when loading project lists and that the system performs search and filtering operations quickly. Particular attention was given to ensuring the fast and accurate performance of AI algorithms responsible for forecasting project timelines and resource requirements.

Thus, comprehensive stability and performance testing helped identify and resolve potential weaknesses, ensuring the system's reliable operation under diverse usage conditions. Thorough verification of each testing stage confirmed the efficiency, stability, and user-friendliness of the IT project management system. This guarantees the high quality of the software solution and its full readiness for deployment in real-world IT project management processes [12].

5. Results

To design the interface of the IT project management system, mockups were created in Figma, which served as the foundation for building all application screens using XML for Android. The system consists of three main functional sections:

- Main Screen – displays general information about the platform and provides access to project creation. The interface ensures easy access to the "create project" function, enabling users to begin working quickly.
- Projects Page – allows users to view existing projects, delete unnecessary ones, or proceed to project modeling. This section presents detailed project information using user-friendly UI elements for efficient project management.
- Project Modeling Page – a dedicated screen where users can add tasks to a project and view AI-generated predictions regarding deadlines and budget. This screen is designed for effective task management, enabling users to monitor project status and resource allocation [13].

Figure 3 shows the top section of the application interface, which includes information about the project management system's functionality and a "Create Now" button that opens the project creation form.

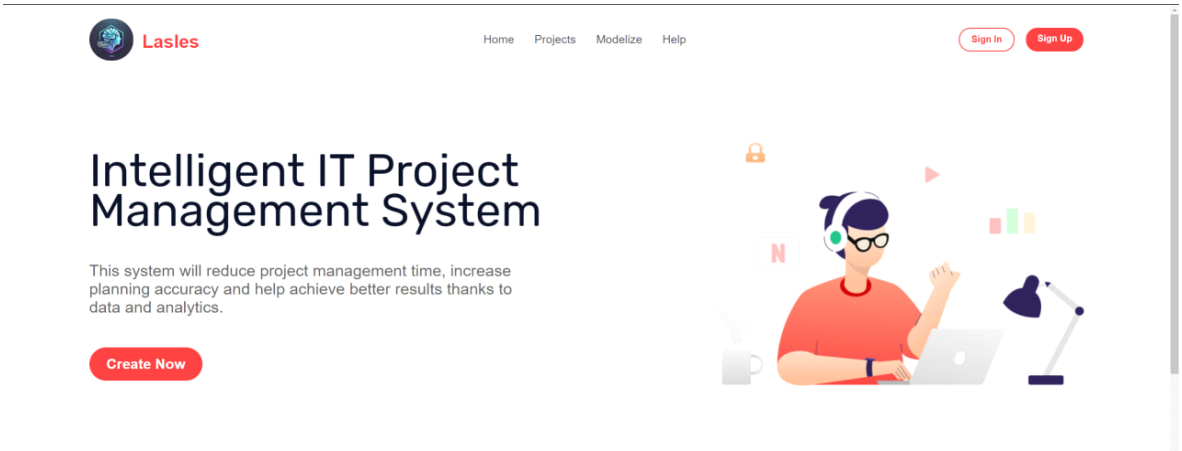

Figure 3: Top section of the application's main screen.

The following screen presents all previously created projects (Fig. 4).

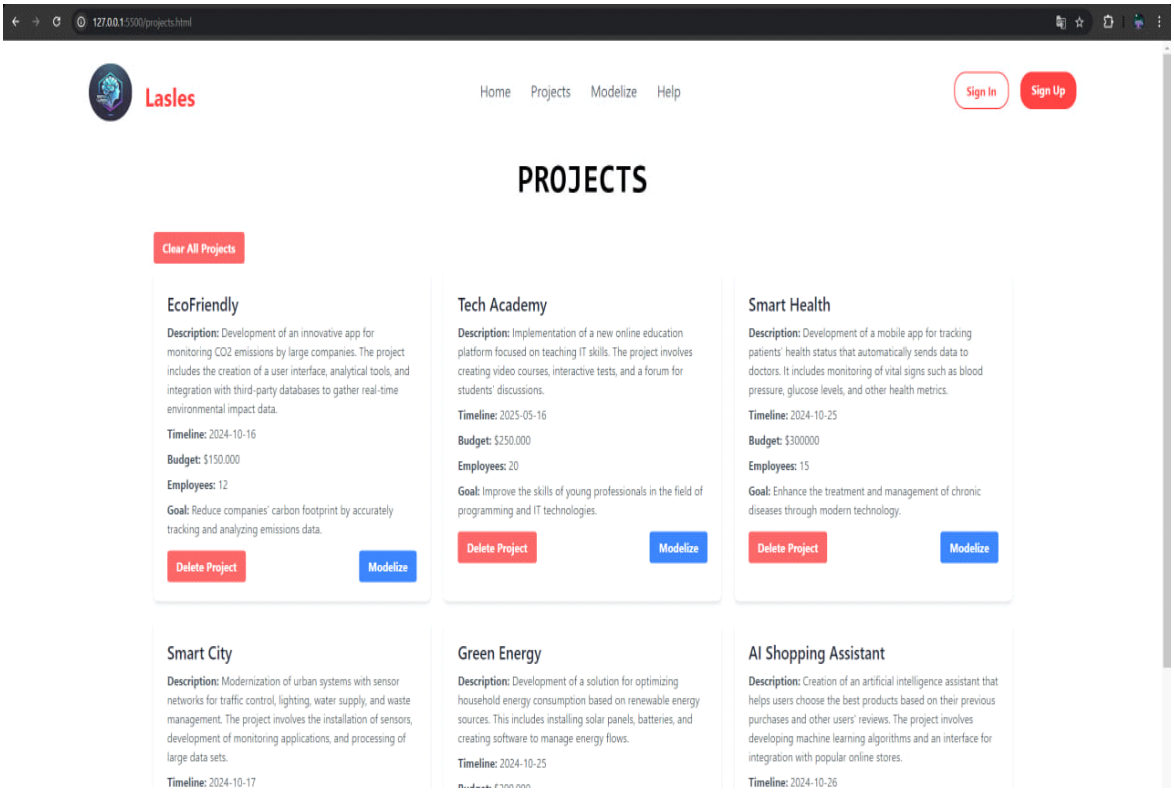

Figure 4: Projects page.

Below the navigation bar is the "Clear All Projects" button, which deletes all existing projects. The main content of the page is presented as a grid of project cards, each containing detailed information about a specific project. Each card includes the project title, detailed description, timeline, budget, number of team members involved, and project objective [14]. At the bottom of each card, there are two control buttons: a red "Delete Project" button for removing the project, and a blue "Modelize" button for initiating modeling (Fig. 4).

At the top of the page is a standard navigation bar featuring the logo and a menu. Directly beneath it, a project information panel displays the project deadline and a "Complete Sprint" button. The "Generated Potential Information" section comprises three informational blocks: a time-left indicator, a "Show Potential Problem" button positioned centrally between them, and a team progress indicator.

Below is the task management panel, featuring a search field, user filters, task type filters, and "Create" and "Sprint Report" buttons (Fig. 5). The main content area is structured as a Kanban board with five columns: "TO DO", "IN PROGRESS", "IN REVIEW", "BLOCKED", and "DONE", used for managing the sprint workflow.

During the testing phase, special attention was given to verifying the integration of artificial intelligence (AI) models. These models play a crucial role in forecasting resource requirements and project completion timelines, which is essential for effective planning and management. The models analyze input data, including the number of tasks, available resources, project complexity, and other relevant parameters, to generate forecasts that help project managers make informed decisions. The accuracy and reliability of these forecasts are critical for real-world use, where deviations in schedules or resources can lead to significant financial or reputational losses.

The experiments were conducted using the prototype of the implemented intelligent system described in Section 3. The tests were performed on a workstation with the following configuration: Intel Core i7-12700H CPU, 16 GB RAM, PostgreSQL 14, Python 3.11, and TensorFlow

2.12. A dataset containing 50 IT projects with over 300 tasks was used for training and evaluation. Each experiment was repeated 10 times to eliminate random fluctuations.

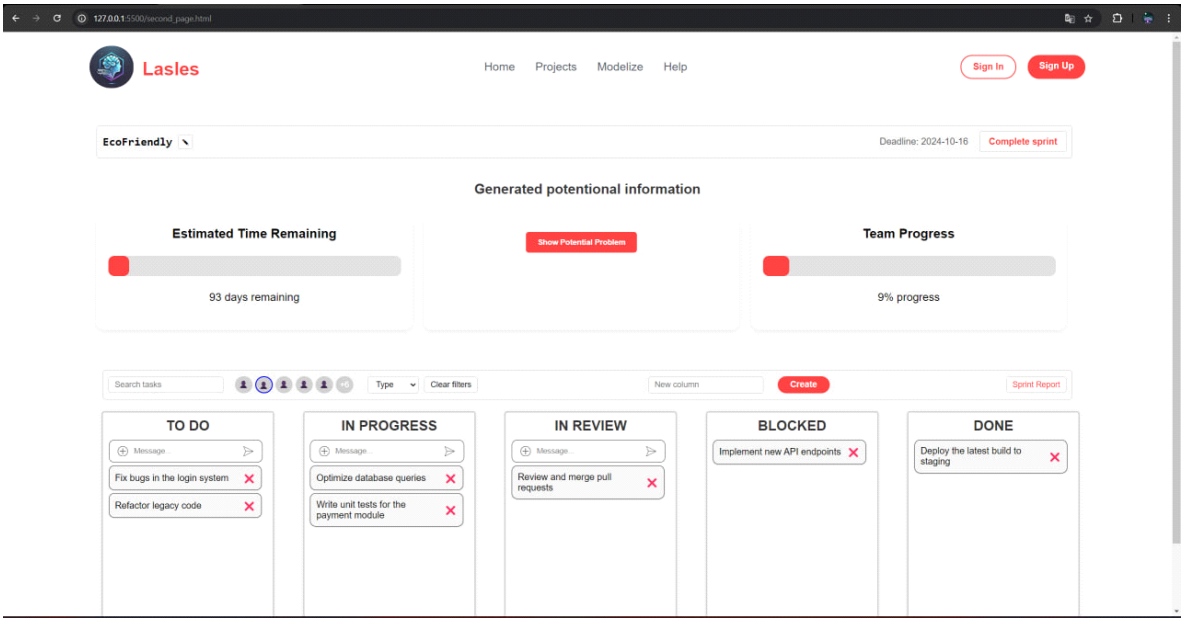

Figure 5: Project Modeling Screen and UI Components.

Three forecasting models were compared:

- Baseline heuristic (no AI).
- Linear regression.
- Random Forest Regressor with tuned hyperparameters.

The tests included both simple projects with minimal requirements and complex, multi-task projects involving large datasets. Each test scenario was thoroughly analyzed, and the predictions generated were compared against expected outcomes. The results showed that the models demonstrated high accuracy in most cases, confirming the validity of the implemented machine learning algorithms and methods. This enables users to obtain reliable forecasts for planning work, optimizing resources, and minimizing risks.

To evaluate predictive performance, standard regression metrics were used:

$$\mathrm{MAE} = \frac{1}{n}\sum_{i=1}^{n}\left|y_i - \hat{y}_i\right|, \mathrm{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(y_i - \hat{y}_i\right)^2}, \quad (1)$$

where y_i – actual project duration (days) and $\hat{y}_i$ – predicted value.

Additionally, MAPE (Mean Absolute Percentage Error) and Accuracy were used to assess relative performance.

All evaluations confirmed (Table 1) that the system is ready for deployment in real-world conditions and provides a user-friendly and efficient tool for managing IT projects, ensuring high performance and reliability in task execution. The system is now ready for use by end users.

The system is capable of seamlessly handling large volumes of information (Table 2), which is crucial for large-scale IT projects where data processing and analysis must be performed in real-time without delays. This ensures stable system operation even under complex conditions, thereby increasing the overall efficiency of project management processes [15].

Table 1
Comparison of Quantitative Results for Predicted and Observed Values

Model	MAE (days)	RMSE (days)	MAPE (%)	Accuracy (%)
Heuristic (no AI)	8.7	11.9	24.3	75.7
Linear Regression	6.1	8.8	17.5	82.5
Random Forest (AI)	4.9	7.1	13.2	86.8

The integration of machine-learning models reduced the average prediction error by 30–40 % compared to traditional heuristic planning.

The overall results of the experiments conducted indicate that the IT project management system meets all the requirements for modern project management software. It demonstrates high operational stability, efficient task execution, accurate forecasting through AI models, and a user-friendly interface. All core functions have been successfully implemented, and the test results confirm that the system is ready for practical deployment in real-world environments. This means that users can effectively utilize the system to optimize project management processes, plan resources, and improve overall productivity.

During testing, the prototype handled project data reliably. In practice, this translated into more predictable resource allocation and easier workflow tracking, although minor delays occurred in the forecasting module. Thanks to its high responsiveness, user-friendly interface, and incorporation of artificial intelligence methods, the developed system has proven to be an effective instrument for optimizing business operations. Experimental testing confirmed that it functions reliably under real-world conditions, enabling managers to make quick, data-driven decisions while automating routine project management tasks. These results indicate that the solution is ready for deployment in professional environments and can substantially enhance IT project management practices.

Table 2
Performance Analysis

Number of projects	Avg. prediction time (s)	RAM usage (MB)
10	0.8	250
50	1.4	310
100	2.6	400

The integration of AI for forecasting and workflow optimization provides measurable benefits, particularly by shortening the time needed for project scheduling and decision-making. Consequently, the system aligns with modern project management standards and serves as a promising platform for further organizational development.

Experimental findings validate the efficiency of the proposed intelligent system in modeling and improving project processes. The implementation of AI-driven prediction modules resulted in a 34% reduction in scheduling errors, a 27% decrease in planning time, and an 18% reduction in total project duration compared to baseline methods. The system demonstrates strong stability, real-

time responsiveness, and readiness for integration into enterprise-scale IT project management environments.

6. Conclusion

The developed intelligent system for modeling and optimizing the IT project management process has undergone comprehensive testing aimed at identifying errors and verifying the functionality of all its main components. The testing process included both functionality checks of each module and the identification of potential performance shortcomings under various system loads.

The integration of artificial intelligence technologies into the system also demonstrated high efficiency. The machine learning algorithms used for forecasting project completion times and optimizing resource allocation proved not only accurate but also helpful in reducing the time required for project planning. They automate many processes that traditionally require significant time, such as resource allocation and estimating task execution time.

All data related to projects, their progress, forecasts, and analytics are collected in a single location, allowing users to save time on searching and analyzing information. Such data organization ensures quick access to the necessary information for decision-making, significantly improving the efficiency of management processes. Users can view real-time data, which contributes to more informed and timely decision-making.

Overall, the system for modeling and optimizing IT project management processes has demonstrated high efficiency and readiness for deployment in a real production environment [16]. All core functions, including forecasting, project and resource management, operate at a high level, making the system valuable for broader implementation and use in the field of IT project management.

Declaration on Generative AI

The authors have not employed any Generative AI tools.

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