WEP Warwick Evans Publishing

International Journal of Computer Science and Information Technology

ISSN: 3005-9682 (Print), ISSN: 3005-7140 (Online) | Volume 2, Number 3, Year 2024
DOI: https://doi.org/10.62051/ijcsit.v2n3.13
Journal homepage: https://wepub.org/index.php/IJCSIT/index

A Method for Developing Information Management System Based on Low-Code

Jianjun Song*

Shanghai Technical Institute of Electronics & Information, Shanghai 201411, China
*Corresponding Author: songjianjun151@163.com

ABSTRACT

This paper presents a low-code system development method centered on forms and processes. The relationships among users, organizations, roles, and permissions within information systems are analyzed. An overview of the functions of forms and processes is provided, where forms are used for inputting and displaying information, and processes are utilized to control the flow of information. A case study based on a low-code platform is conducted to validate the feasibility of the proposed method.

KEYWORDS

Low-Code, Information Systems, Data, Forms, Process, Permissions

1. INTRODUCTION

Low-Code is a method of application development that employs visualization. It necessitates little to no coding and relies on “drag-and-drop” visual operations to create an environment for application development. This approach to software creation has gained significant traction in recent years. Low-Code, due to its characteristics of low cost, high efficiency, extensibility, and flexibility, has emerged as one of the favored tools for digital transformation over the past few years. Currently, Low-Code development is extensively applied in numerous fields, including business digital systems, smart Internet of Things (IoT), mobile app creation, and digital marketing, among others. Low-code development platforms assist developers in constructing applications that are quick, efficient, and scalable with minimum coding requirements, giving rise to the concept of citizen developers in the sphere of application development [1].

Nowadays, there is a high demand for professionals with digital skills in the field of Information [2], especially in the field of low-code development. Low-Code has revolutionized the way corporate software is produced, acting as an efficient tool and delivery platform for future enterprise production [3]. It can effectively lower the development threshold and save on labor costs [4]. Low-code development platforms (LCDPs) reduce the need for writing code, thereby demystifying software development for non-IT employees [5]. Researchers have pointed out that the most critical trait of future business development is that it is driven by non-developer workers [6].

The development process of low-code information systems can be summarized as requirement analysis, functional planning, system construction, testing, and deployment, as illustrated in Figure 1. The aim of requirement analysis is to precisely define the software's functionalities and objectives. Functional planning refers to the detailed planning of the information system based on system requirements, which encompasses aspects such as functionality, interface, and process. System construction involves determining and implementing a construction plan for the system. Testing and

deployment, conducting system tests and performance assessments and deploying the system to the target environment. Market research institutes forecast a growing relevance of LCDPs for organizations [7].

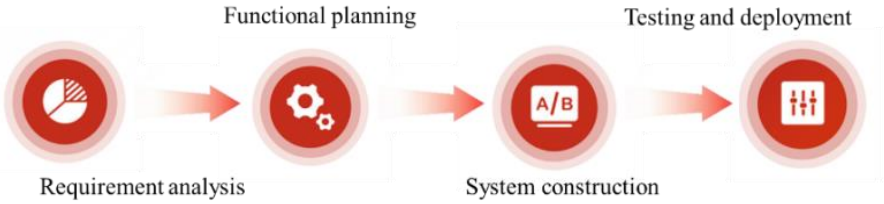

Figure 1 Low-code system development process

This study will explore a universal methodology for low-code information system development, focusing on forms and processes in our research, and provide an analysis and summary of the specific development process. Based on the proposed development method, an information system will be designed using an actual low-code platform to verify the feasibility of the method.

2. METHODOLOGY

2.1. The Low-Code Development Method Centered on Forms and Processes

It is widely acknowledged that the scarcity of professional software developers constitutes a significant barrier for many enterprises in successfully navigating digital transformation [8]. In 2014, a novel software development paradigm began to emerge: low-code development [9]. In this study, the low-code development method based on low-code platforms or tools is centered on forms and processes. This methodology primarily realizes the creation, management, and design of forms and processes through visual tools and graphical interfaces, providing substantial assistance in rapidly constructing business processes and enhancing user experience. This approach primarily utilizes visual tools and graphical interfaces to facilitate the creation, management, and design of forms and processes, substantially aiding in the rapid construction of business processes and enhancing user experience.

A form refers to an interface element used for data collection, display, or both. In a low-code environment, developers can customize their forms via drag-and-drop and configuration, potentially consisting of elements like text boxes, input fields, drop-down menus, check boxes, among others. A process denotes the definition and execution of a series of tasks and business rules, with developers employing low-code platform tools for visual design and editing. Tasks within a process may be manually operated or automatically executed, with specific conditions and rules set based on the needs, thus defining the logic and trajectory of the entire process. This method can be specifically summarized, as shown in Figure 2:

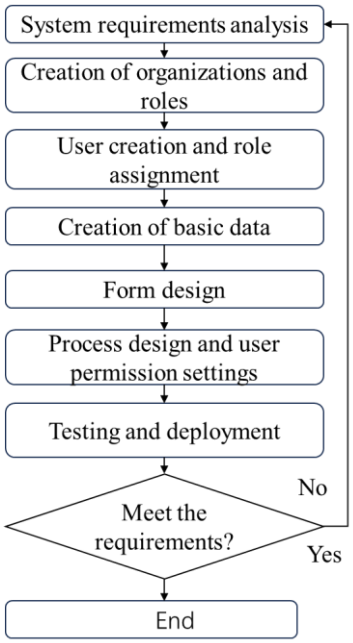

Figure 2 The methodology process

(1) System requirements analysis, to clearly define the functions and goals of the information system.

(2) Creation of organizations and roles, to establish the organizational structure and user roles required by the information system.

(3) User creation and role assignment, to create some commonly used users in the information system and assign them certain roles. User accounts can also be created continuously during the subsequent development and usage process.

(4) Creation of basic data, as it forms the basic elements of the information system. By creating basic data, the reuse rate of basic elements can be increased while ensuring data consistency.

(5) Form design, to design interface elements for user interaction with the system.

(6) Process design and user permission settings, to allow data to be passed according to certain rules and enabling users with different permissions to perform corresponding operations on the data.

(7) Testing and deployment. This involves system testing and performance testing, as well as deploying the information system to its usage environment.

(8) If the system does not meet the requirements, the information system will need to undergo further optimization.

2.2. System requirements analysis

The System requirements analysis of low-code development refers to a thorough investigation and analysis of the necessary functions and features of the low-code information system to be developed, aiming to clarify the development objectives, guide the architecture and technology direction, and address the issue of requirement change. The expectation of business requirement analysis is to clearly define the functions and objectives of the software, and to communicate and confirm the requirements with the customers. The analysis consists of requirement investigation, analysis, and comprehensive sorting, summarizing the objectives that the system needs to achieve, and confirming the basic functions that the system should have.

In addition, it is necessary to determine the non-functional requirements of the system, such as reliability, usability, security, and user experience. The non-functional requirements can be specifically summarized as follows:

Reliability: Being able to provide efficient, stable services and ensure the accuracy and integrity of data.

Usability: Easy to use and can respond to user requests within a reasonable time.

Security: It is necessary to ensure user privacy and data security to prevent data leakage.

User Experience: It is necessary to provide a simple, easy-to-understand interface, and provide efficient and convenient services.

2.3. Users, Organizations, Roles, and Permissions

Users refer to the individuals or groups who build, customize, and use information systems through low-code development platforms. The low-code information systems are built by users and are also purposed for user utilization. The organization refers to the institution that the users belong to. Organizational management is a common function of information systems. In low-code information systems, different users play different roles in the system, and each role has different permissions and functions.

Common roles include administrators, data managers, employees, and department managers, among others. Role configuration refers to the categorization of system users into different classes, such as administrators, human resources personnel, employees, etc., and assigning different permissions to each role to facilitate management of user rights. Permission settings refer to the division of system functions and operations, such as querying employee information, editing employee information, deleting employee information, etc., and stipulating the corresponding permissions for each role to ensure that users can only perform authorized operations. Figure 3 is a schematic diagram of the information system users, organizations, roles, and permissions, through which the relationships among them can be well understood.

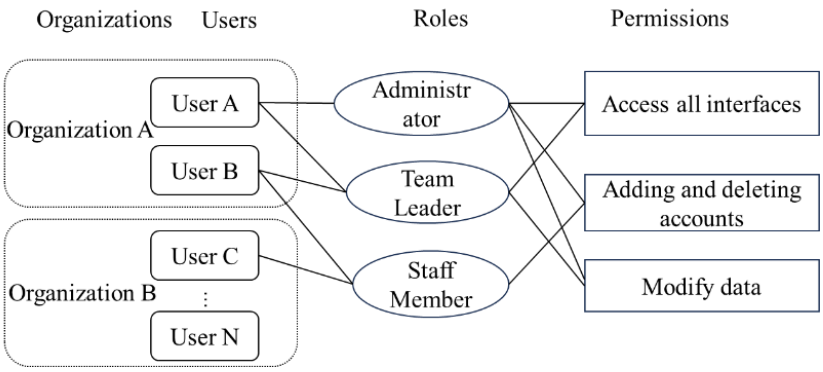

Figure 3 Schematic diagram of the system users, organizations, roles, and permissions

2.4. Data Creation and Management

Data serves as the foundational element in the architecture of information systems. The purpose of creating such data is to enhance the efficiency of information system development and to ensure data consistency and integration. By establishing uniform fundamental data, it is possible to prevent conflicts and discrepancies among different applications. Furthermore, fundamental data can facilitate the integration and sharing of data across various applications, thereby augmenting the overall efficiency and collaboration of the system. Commonly used fundamental data are enumerated data, which is a method for storing some fixed data, mainly presented in the form of drop-down boxes. Common examples of enumerated data include gender (male/female) and marital status (married/unmarried), among others. In addition, there are other methods for storing some fixed data, mainly storing personalized data in the form of tree structures, grouped lists, and lists.

2.5. Form Construction

Forms are a key medium of information in information systems, capable of visually presenting data and providing user interaction. They serve as one of the fundamental tools for data input, modification, and output within information systems, and are also one of the primary methods for user-system interaction. Forms generally consist of various components such as input boxes, text boxes, drop-down lists, and so on, utilized for collecting and displaying data. Fundamental data provisions the primary data elements for the design of forms, ensuring the efficiency of development and the consistency of data.

Form interface design refers to the design process of creating and customizing user interfaces within low-code systems. It aims to provide user-friendly, intuitive, and effective interfaces so that users can conveniently browse, operate, and manage form data. Form interface design generally includes the design and configuration of elements such as layout, navigation, input controls, tables, and charts.

2.6. Process Management

A process refers to a series of tasks and business rules defined and executed. Low-code process design utilizes visual tools to define and execute a sequence of tasks and business rules, allowing for both manual and automatic task handling, with execution logic and routing set by conditions and rules. It enables rapid creation, modification, and management of complex business processes, offering standardized, automated, and flexible workflows. With the capability for swift iteration and adaptation, low-code systems ensure ongoing optimization of business processes in line with evolving requirements. Figure 4 is a process schematic where the purchasing officer initiates the purchase form, the procurement manager approves it, and the process ends after the finance staff agrees to proceed with payment.

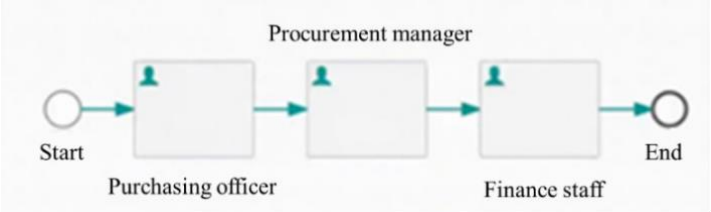

Figure 4 Schematic diagram of the process

3. CASE STUDY

Human resource management is pivotal for a company's growth and ongoing improvement, particularly as digital transformation becomes an essential trend. This discipline covers aspects such as planning, recruitment, performance management, training, compensation, and employee relations. The aim of this project is to establish an onboarding management system that leverages digital tools to facilitate rapid, stable, efficient, and secure information system operations.

This system enables more streamlined and effective management of new employee onboarding, optimally matching them to departments and reducing errors in the onboarding process. Utilizing a low-code platform, the system is designed to demonstrate the efficiency of this development approach, with Figure 5 displaying the system login interface.

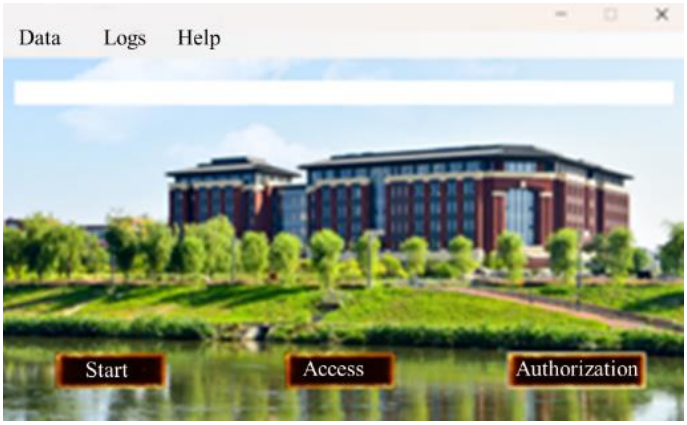

Figure 5 The system login interface

3.1. Requirements analysis

The onboarding management system, widely used in modern products, streamlines the archival management of new hires through web interfaces. Its primary functions include the management of departmental data, job information, compensation types, and entry documentation, among others. Implementing this system can transform enterprises by:

(1) Enhancing efficiency: Automating onboarding processes allows for swift management of vast information volumes, improving operational efficiency.

(2) Increasing accuracy: The system minimizes manual record-keeping errors and provides automatic notifications to approvers, reducing mistakes.

(3) Boosting reliability: It ensures all employee-related information is accurate and dependable.

(4) Improving security: The system protects employees' personal information and secures data.

(5) Enhancing collaboration: It promotes inter-departmental cooperation and ensures approvers are well-informed about new hires.

3.2. Creation of organizations and roles

L Group is a private enterprise primarily engaged in internet and related services, with branches in Beijing, Shanghai, and Shenzhen. Table 1 presents its organizational structure.

Table 1 System organizational structure

Institutional Code	Institutional Name	Instruction
A	L Group	Group Headquarters
B	L Group Beijing Branch	Beijing Division
C	L Group Shanghai Branch	Shanghai Division
D	L Group Shenzhen Branch	Shenzhen Division

Through the configuration of user rights management, the behavior of different types of users can be controlled, ensuring the system's stability and secure operation. The specific roles and permission settings are as follows:

Recruitment Specialist: Possessing the authority to access and create onboarding application forms.

Recruitment Supervisor: Possessing access rights, has the authority to approve (pass/reject) the submitted forms.

Department Manager: Possessing access rights, has the authority to approve (pass/reject) the submitted forms.

Division Director: Endowed with access rights and final decision-making authority, holds the capacity to consent to or reject the submitted forms.

System Administrator: Responsible for the modification and maintenance of system information.

3.3. Creation of basic data

Creating the fundamental data elements that constitute the information system. An explanation of enumerated data creation is presented using the establishment of "Marital Status" as an example, with the values namely, "Married" and "Unmarried". The formation of other basic data is illustrated with the example of the creation of job position basic data, establishing data for "Java Development Engineer", "Web Front-end Engineer", "Testing Engineer", "Recruitment Specialist", "Operation and Maintenance Engineer", and "Human Resources Specialist".

3.4. Form design

Data modeling is employed to preset all significant information contained in the form and defines the form model in the form of a worksheet. This indicates that prior to designing the form interface, it is essential to pre-arrange the information (field column information) present in the form itself. The form comprises both main table and sub-table information. Generally, fields that can be wholly displayed in an input box are designed in the main table of the form, while the information with an uncertain number of rows is structured in the sub-table of the form. It is requisite to publish the outcomes post-design completion.

The purpose of interface design is to offer a user-friendly, intuitive, and efficient interface so that users can conveniently browse, operate, and manage the form data. Figure 6 presents a form with a completed interface design.

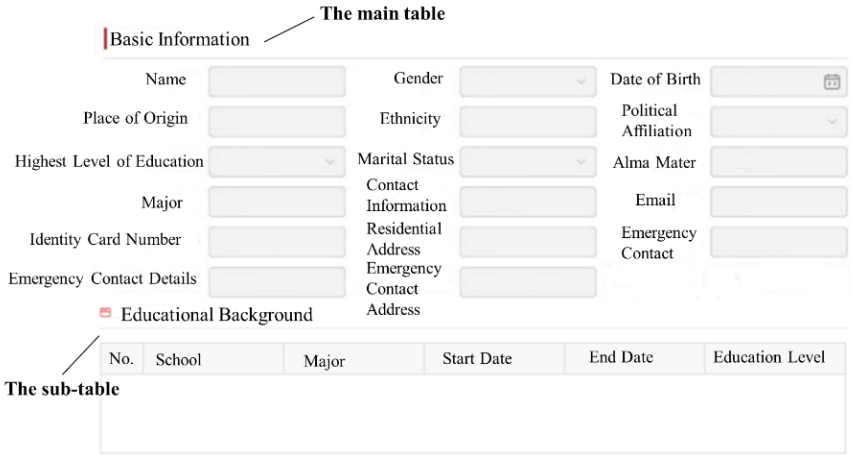

Figure 6 Form interface

3.5. Users, Permissions, and Processes

Establish multiple users as depicted in Table 2, assign roles to these users, manage each role respectively, and delegate different authorities to each role.

Table 2 Users and roles

Users	Roles	Organizations	Permissions
User1	System Administrator	L Group Shanghai Branch	Management and Maintenance of Information Systems
User2	Recruitment Specialist	L Group Shanghai Branch	Initiate Process
User3	Recruitment Supervisor	L Group Shanghai Branch	Approve/Reject
User4	Department Manager	L Group Shanghai Branch	Approve/Reject
User5	Division Director	L Group Shanghai Branch	Final Decision

The business process design ensures that incoming employees can carry out the normal workflow of the entire business under one process and can quickly change the process strategy and timely resolve issues when encountered situations that do not comply with the original process. The specific process is shown in Figure 7:

(1) Firstly, the recruitment specialist fills in the entry application form and submits it to the recruitment supervisor for approval.

(2) After approval from the recruitment supervisor, it is handed over to the department manager for approval.

(3) Then, it is handed over to the division director for approval. Once the approval is complete, the hiring approval process ends.

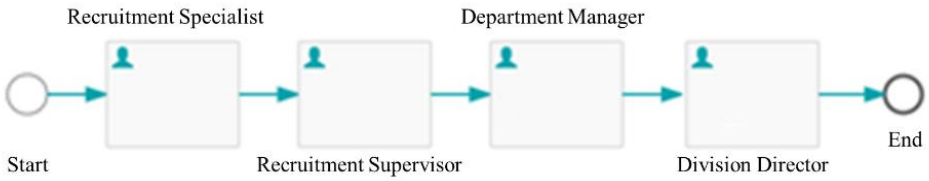

Figure 7 Business process

4. SUMMARY

The methodology proposed enables the efficient establishment of an information management system. Figure 8 illustrates the system login interface, while Figure 9 depicts the operational interface of the system, thereby demonstrating the feasibility of the approach.

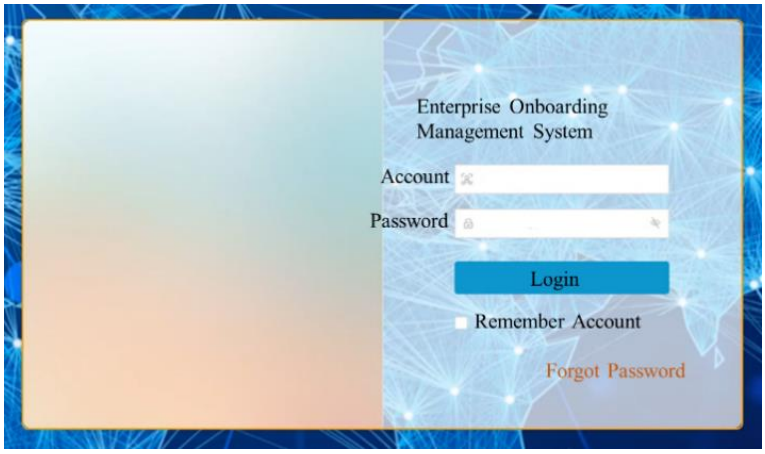

Figure 8 Login interface

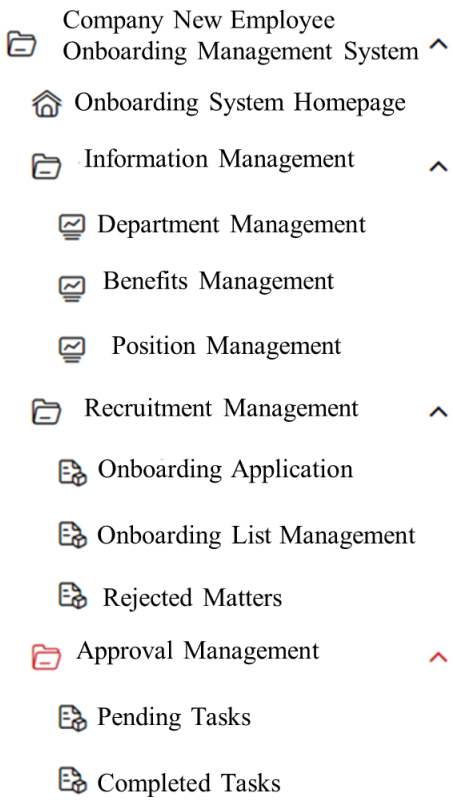

Figure 9 System operation interface

5. CONCLUSION

This paper proposes a low-code system development methodology centered around forms and processes. It analyses the relationships among users, organizations, roles, and permissions within information systems. An overview of the functions of forms and processes is provided, with forms serving to input and display information, and processes controlling the flow of information. A case study is conducted using a low-code platform as an exemplar to validate the feasibility of the proposed method.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

ACKNOWLEDGEMENTS

The author received support from Association of Fundamental Computing Education in Chinese Universities for the research.

REFERENCES

[1] ALSAADI, H. A., RADAIN, D. T., ALZAHRANI, M. M., ALSHAMMARI, W. F., ALAHMADI, D., & FAKIEH, B. (2021). Factors that affect the utilization of low-code development platforms: survey study. Romanian Journal of Information Technology & Automatic Control/Revista Română de Informatică și Automatică, 31(3).

[2] Metrolho, J. C., Ribeiro, F., & Araújo, R. (2020). A strategy for facing new employability trends using a low-code development platform. In INTED2020 Proceedings (pp. 8601-8606). IATED.

[3] Jiang Weixiang, & Zhao Litong. (2024). Design and Implementation of a Hotel Room Management Platform Based on Low-Code Platform. The New Generation of Information Technology, (null), 1-9.

[4] Zhang Yaoyu. (2024). The application of low-code in data platform development. Software and Integrated Circuits(Z1), 2-5. doi:10.19609/j.cnki.cn10-1339/tn.2024.z1.004.

[5] Iho, S., Krejci, D., & Missonier, S. (2021). Supporting Knowledge Integration with Low-Code Development Platforms. In ECIS.

[6] Chang, Y. H., & Ko, C. B. (2017). A study on the design of low-code and no code platform for mobile application development. International journal of advanced smart convergence, 6(4), 50-55.

[7] Prinz, N., Rentrop, C., & Huber, M. (2021, August). Low-Code Development Platforms-A Literature Review. In AMCIS.

[8] Bock, A. C., & Frank, U. (2021). Low-code platform. Business & Information Systems Engineering, 63, 733-740.

[9] Bucaioni, A., Cicchetti, A., & Ciccozzi, F. (2022). Modelling in low-code development: a multi-vocal systematic review. Software and Systems Modeling, 21(5), 1959-1981.