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# Land Ownership Management System in Mosul City

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**Abstract**

Technological development in all areas of life has played an effective role in the development of electronic systems. They have become one of the necessary modern building systems used by the government in order to facilitate the work of employees and reduce the effort and time of the employee and citizen worker. This research suggested searching for an electronic platform for private property matters between departments so that all specializations would be transferred from the basic system to the electronic system. This system is considered a platform and does not require submitting ownership transfer requests easily and quickly via the Internet. The system provides a great opportunity to progress their transactions on a regular and continuous basis, providing accurate information about the progress of their transactions and the specific time for completing them.

***Keywords***:
distributed systems, distributed databases, servers.

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## 1. Introduction

The current era has witnessed a great development in the field of technology and information, and the modern technological systems have facilitated transactions in our daily lives. This technology has forced on all government institutions and the private sector to transform their traditional systems into modern electronic systems that meet their requirements faster and with the lowest financial costs [1]. Electronic systems in state institutions have eliminated many of the problems of traditional paper-based systems and the accompanying costs involved. Electronic systems are characterized by the volume of stored data and the speed of retrieval and transfer between branches of the institution, in addition to the ease of generating accurate statistics within an ideal time and relying on database systems and communications systems [1]. In order to save data and quickly process it using advanced modern technologies, many academic and commercial institutions have begun to adopt electronic systems [2].

Most government institutions and departments choose to keep pace with this progress and work to automate their systems according to contemporary technical and scientific principles, due to the efficiency and accuracy these systems provide in solving functional problems. These government departments include service departments that have established electronic platforms, such as the Traffic Department, the Nationality and Personal Status Department, and others. In order to provide simple and quick services to citizens, tried Enabling and overcoming many of the challenges posed by legacy systems.[3] [4]. (Distributed system) is a group of computers connected via a network and performing common functions for a specific system through the exchange of data and messages. The primary task is divided into a number of smaller tasks that are distributed over several computers, and then compiled back into the main computer where the results are shown [5].

## 2. The Previous Works

All systems used today are traditional systems that have been converted into electronic systems to help government agencies perform more efficiently. On the other hand, electronic systems have a great impact because they make it easy to complete important processes that are difficult to complete manually, quickly and accurately.

Many solutions have helped transform the traditional system into an electronic system and regarding these electronic systems for land ownership issues, they can be applied in the event of changing the current paper system to an electronic system using different programming languages and methods. All systems used today are traditional systems that have been converted into electronic systems to help government agencies perform more efficiently. On the other hand, electronic systems have a great impact because they A study by Dijkstra [13] (2017) also aimed to determine The stage in which block chain technology can be used in real estate management, and it reviewed the opportunities and challenges for applying the technology in order to improve the current real estate management process, the most prominent of which are: technical challenges, lack of standards, in addition to the need to organize the process at the governmental level. . The land administration and property registration system is another system described by researchers Combi et al. (2017), which is a system for storing land ownership data and monitoring transactions involving land titles. Since land issues are sensitive, land administration and property registration systems must be reliable to prevent fraud in documents, and to always be available and quick to complete tasks. In order to model such a system, this study will use block chain technology.

The proposed model can be used to collect proof of land ownership from scattered databases. It is expected that society will benefit from this study because there will be a reduction in the time and expenses required to register land ownership [12] A study (Kopylash, 2018) [11] developed a block chain-based real estate system for a real estate company based on the Ethereum platform for smart contracts. A study conducted by Grand et al[10] (2018) also developed a Land Council system that improves its service delivery as a result of increased adherence to policies, reduced errors, online services, enhanced record security, and simplified access to records.

In order to be relevant in the current environment, it is recommended that companies evolve over time and keep improving their record-keeping procedures. Researcher Muhammad Shuaib et al [8] (2020) built the land registry system, which is one of the critical components of any government framework that maintains real estate ownership records.

## 3. Programming Languages and Libraries Used in System Development

Different programming languages and libraries were used in developing the system which are:
1) Structured Query Language (SQL) is used to design databases and deal with information in them in terms of adding, deleting, modifying, archiving, searching, and other multiple operations. 2) Hyper Text Preprocessor (PHP) language which helps in dealing with data and is an open source programming language 3) Cascading Style Sheets (CSS) language which is used to create cascading programming languages, such as those launched using the browser. Displaying HTML documents that directly contribute to the distinctive look of the site, the text appears to be laid out overall, including the size of the text, its back, layout, and the arrangement of the background pages. It is generally designed 4) Hyper Text Markup Language (HTML) is used to design web pages and change the basic structure of these sites and pages 5) Java Script language which can be used with practically all websites and browsers without using third-party plug-ins. Scripts are programs created in JavaScript that can be inserted directly into the HTML code of a web page to be run when the page loads. These scripts can be created and then executed as plain text and do not need to be specially set up or compiled beforehand. This distinguishes JavaScript from another programming language with the same name. Java. 6) Bootstrap is one of the most famous and powerful libraries that combines HTML, CSS, and JavaScript to build pages, websites, and web applications. It is mainly useful in building websites that are compatible with different screen sizes and measurements. 7) MYSQL Database is used by simple operating systems such as (Mac Os, Linux, Windows), and is created and configured to provide web applications.

## 4. Stages Of System Development

The proposed system was developed in a number of regulatory stages followed in developing approved systems, which are:

### A. System Requirements Analysis

The system analysis stage provides a solid and trustworthy foundation for completing the following system stages of designing, implementing, and testing the system. This is the crucial and main stage in systems development, as it includes analyzing all functional and non-functional system requirements, as well as how databases are represented, and a description of all the operations it performs. The way in which the system operates, from the point of entering and processing data to the point of collecting and showing results. Therefore, the system requirements were divided into two parts.

### B. Functional requirements

It includes all the tasks that the proposed system must perform in order to meet the administrative requirements for real estate registration, which are: First: System Administrator Requirements: These include the requirements for the System Administrator, which are summarized as follows:1)Absolute access to all parts of the system using (email and password). 2) The ability to modify system properties, including (adding, deleting, and modifying). 3) The authority to enter employee data such as (employee name, email, password, department) 4) The authority to add and delete employees from the department's departments. 5) The ability to modify databases by creating, deleting, modifying or importing. 6) The authority to inquire about information related to the citizen and the transaction, prepare reports, and issue results. 7) The authority to configure login accounts (email and password) for employees. Second: Citizen requirements: This means the permission granted to the citizen summarized as follows:

1. The ability to access the system through users account using the e-mail and password that was previously registered with
2. The possibility of following up on the status of the transaction by the citizen, in which department, and what the fees are What he owes
3. The possibility of knowing the completion of the transaction through the completed transactions tab.

### C. Non-functional requirements

These requirements include all scientific instructions used for electronic systems that would make the system easier to use, including:

- System flexibility and simplicity:
  This characteristic deals with the design of system interfaces, which requires simplicity of interfaces and implementation of operations. The system must also be compatible with the many devices and operating systems used by citizens:
- Confidentiality of information:
  The system must ensure that information is handled with the utmost care, maintain its privacy, restrict access to it using each citizen's e-mail and password, prevent unauthorized access, and prevent tampering
- The ability to modify and develop the system: The system must allow modification and change without the need to make fundamental changes to the system. In addition, it provides the opportunity to expand the system and integrate new features.

### D. Analysis of System Operations

Using diagrams to represent models gives an accurate description of the system. Therefore, a number of models and diagrams were created to give an integrated description of the system mechanism and the relationships between the system's databases, which facilitates the process of designing the system efficiently and without errors. A number of diagram models were created to analyze the system processes based on the Unified Modeling Language, where the system's work structure was described in general using (System context diagram) by describing the system inputs as well as all the processes that occur within the system as well as clarifying the flow of information between the system processes. Then show the final outputs of the system. This diagram is an external view of the entire system, as shown in **Fig. 1**.

The Use Case Diagram was also used, which explains the powers of all users of the system as well as the functions that each of them performs. It also describes the interaction between the system and its users by describing a general idea of how the system deals with the external environment, as shown in **Fig. 2**.

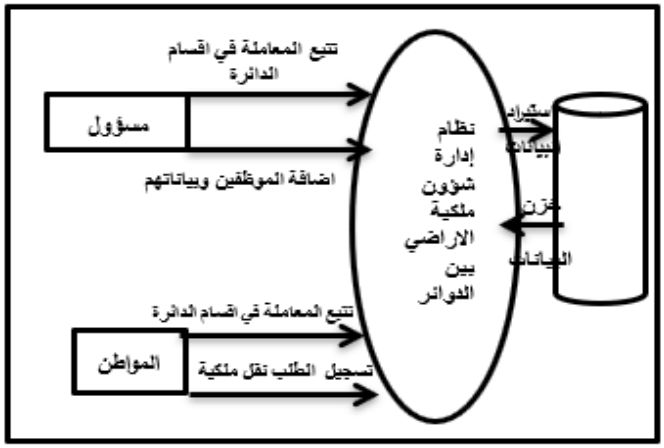


**Fig. 1.** System context diagram.

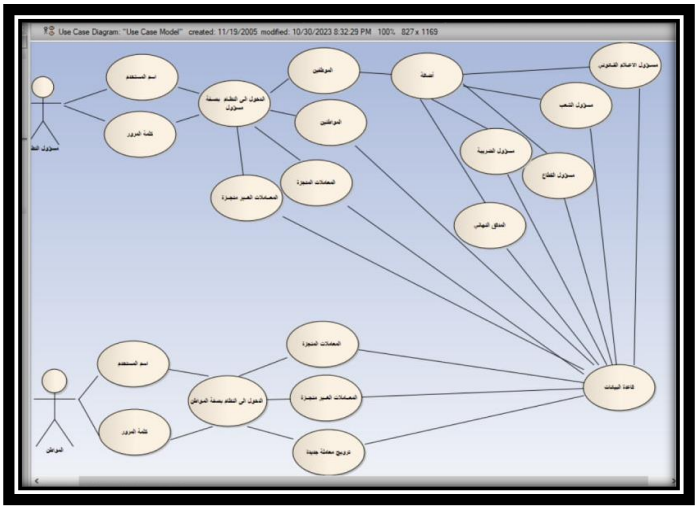

**Fig. 2.** Use case diagram.

## 5. Database Design

The database design phase begins after the end of the analysis phase of the operations carried out by the system, as the system database consists of two tables, which in turn

contain a set of fields, as follows:

- Entering the system as an administrator: The administrator can enter the system using his username and password, and he can add or delete any employee, deal with transactions, and withdraw reports.
- Entering the system as an employee:

  Here the employee can enter the system using the e-mail and password provided by the manager, and in turn, he can complete the specialized transaction procedures in this section.
- Entering the system as a citizen: Here, any person can enter the system, read the instructions and an overview of it, view the system, and submit a request for the transaction. Table (2) describes this information.

**Table 1.** Citizen information data.

| Field title | | Field description |
|---|---|---|
| 1. | id | Master key |
| 2. | name | the name |
| 3. | email | E-mail |
| 4. | Email_verified_at | Email authentication date |
| 5. | password | Password |
| 6. | position | Position |
| 7. | role | Gender |
| 8. | Remember_token | Code reminder |
| 9. | Created_at | Beginning of registration |
| 10. | Updated_at | End of registration |

## 6. System Architecture Framework

The structure of the proposed system shown in **Fig. 3** consists of three main parts. The first part is a computer used by the system administrator (manager) to work on adding and deleting employee data as well as preparing and printing reports, and the second part is the computers that are used by employees (media officer). Legal, divisional official, sector official, tax official, final auditor official) to complete the transaction procedures for each section of the department, and the third part, which is represented by the citizen side, as a computer or mobile device is used via the link to register the request to the department and track the transaction in each section.

**Table 2.** Employee and management information data.

| Field title | | Field description |
|---|---|---|
| 1. | Id | Master key |
| 2. | number | the number |
| 3. | User-id | Link to employee schedule |
| 4. | files | Golden square |
| 5. | Land_owner_name | Name of the land owner |
| 6. | Land_number | piece number |
| 7. | Land_location | Widget location |
| 8. | type | Personal or inherited |
| 9. | wakala | If he is a lawyer |
| 10. | qassam | If he is an heir |
| 11. | Ielam_qanoni_state | Is it completed by the legal media? |
| 12. | Ielam_qanoni_notes | Legal media notes |
| 13. | Ielam_qanoni_fees | Fees for legal media |
| 14. | Dept_selected | Choose the division section |
| 15. | Need_massah | Do you need a surveyor? |
| 16. | Massah_state | Is it completed by a surveyor? |
| 17. | Dept_state | Department status |
| 18. | Qatta_selected | Select the sector section |
| 19. | Qatta_state | Is the sector completed? |
| 20. | Qatta_notes | Sector notes |
| 21. | Water_fees | Water fees |
| 22. | Elec_fees | Electricity fees |
| 23. | Comm_fees | Communications fees |
| 24. | Waqef_fees | Sunni endowment fees |
| 25. | Majare_fees | Sewer fees |
| 26. | Taxes_state | Tax department status |
| 27. | Taxes_fees | Tax fee |
| 28. | Taxes_notes | Tax notes |
| 29. | Security_check | Security audit |
| 30. | Finance_state | Financial audit |
| 31. | Sadera_state | Outgoing |
| 32. | Assistant_state | Assistant seal |
| 33. | Checker_state | Final auditor |
| 34. | Final_state | final state |
| 35. | Created_at | Start Date |
| 36. | Updated_at | Expiry date |

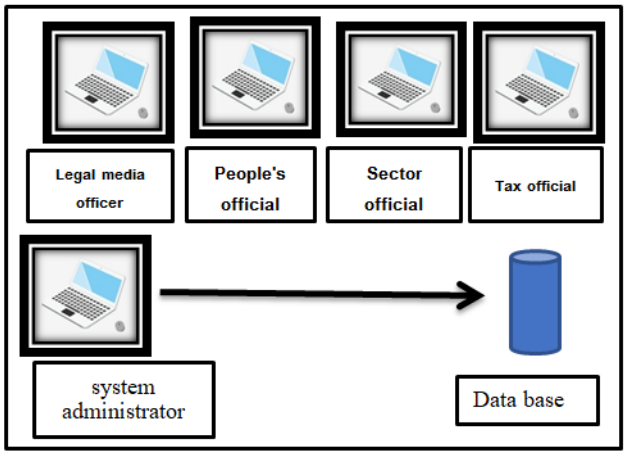


**Fig. 3.** Structural design of the system.

While the flow chart in **Fig. 4** shows the flow of the main processes in the system, the processes carried out by the system can be summarized in the following points:

1- Login to the system after ensuring that the login information is valid and according to the type of user, whether he is a system administrator or login as a department administrator and according to the user's status

2- Log in as a system administrator:

A. The system administrator enters the employees' information and adds each employee according to his department. The process includes entering the employee into the system via the email and password that the manager provides to the employee.

B. The system administrator can delete the transaction if a problem occurs or corruption occurs in the transaction

C. The system administrator tracks the transaction in each department and returns it to the desired department in the event of a problem

D. The system administrator can view completed and uncompleted transactions

3- Login as an employee: If the user logs in as an employee, there is only one possibility, which is to review the transaction and complete all procedures related to this section.

4- Entry as a citizen: It includes the basic processes related to the citizen, which can be summarized as follows:

A - The new transaction promotion page, which is the citizen's registration for a new transaction.

B - Completed Transactions Page, to inform the citizen of the latest notifications and developments, and to view the wages he owes.

C - Uncompleted transactions page, through which the citizen can track the status of the transaction and in which section.

## 7. Design of System Interfaces

The system design includes many interfaces, including those for the system administrator (manager) and other interfaces for employees in the department, as well as the interface for citizens. Therefore, we will discuss the explanation of these types of interfaces and the function of each one.

## 8. The Main Interface for Entering the System

It is the main entry interface for the system, shown in **Fig. 5**, through which the system user accesses the other sub-interfaces of the system according to the powers granted to him, whether he is (the system administrator, or one of the department's employees, or Citizens) based on the username and password, and in the event of forgetting the password, the code will be changed via email.

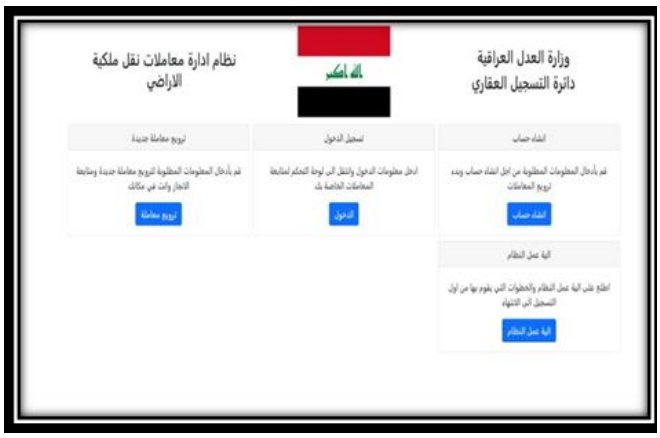


**Fig. 5.** The main interface to enter the system.

## 9. System Administrator Interface

This interface is one of the most important interfaces of the system, which is managed by the system administrator, through which all information is dealt with, starting with adding department employees and tracking the transaction in each department of the department and ending with delivering the transaction to the citizen. In the event of a problem, the transaction is returned to the department in which it occurred. A problem, and also view completed and uncompleted transactions, as shown in **Fig. 6**.

**Fig. 6.** System administrator interface.

Many interfaces emerge from the system administrator interface concerned with managing or controlling the system, including the interface for adding employees, the citizens interface, the interface for completed and uncompleted transactions, and archived transactions. The system provides the ability to enter this data manually through the system administrator, as shown in **Fig. 7** and **Fig. 8**.

**Fig. 7.** Employees interface on the administration page.

**Fig. 8.** Citizens interface on the administration page.

As for the completed and uncompleted transactions button on the administration page, when you click on any of them, the completed and uncompleted transactions will appear as shown in **Fig. 9**.

**Fig. 9.** Interface of completed transactions on the administration page.

**Fig. 10.** Unfinished Transactions Interface.

As for the Archived Transactions button on the administration page, the transaction is archived by the manager in the event that there is an error in the transaction or a problem occurs with it, as shown in **Fig. 11**.

**Fig. 11.** Archived Transactions Interface.

As for the search button, through it, a specific transaction is searched for by a specific date, where all transactions on that specific date are retrieved in the form of a detailed report, or an individual transaction is searched for by the plot number or district number by the manager, as shown in **Fig. 12**.

**Fig. 12**. Transaction search interface.

## 10. Legal Information Officer Interface

The Legal Information Section is one of the departments of the department that is in the first sequence of transaction steps. When the information is entered by the citizen and sent, it goes directly to the Legal Information as shown in **Fig. 13**. When you click on the Review button, it will All transaction information appears as all requirements of this section are completed, as shown in **Fig. 14**.


**Fig. 13.** Legal Information Officer interface.


**Fig. 14.** Legal Media Department review interface.

## 11. Division official interface

The division section is one of the departments of the department that is in the second sequence of transaction steps, where when the information is entered and completed by the legal information official and sent, it is transferred to the division official as shown in **Fig. 15**. When you click on the review button, it will All transaction information appears as all requirements of this section are completed by the responsible employee, as shown in **Fig. 16**.


**Fig. 15.** Division Administrator interface.


**Fig. 16.** The review interface for the division section.

## 12. Interface of the Sector Official

The sector section is one of the divisions of the department that is in the third sequence of transaction steps. When the information is entered and completed by the division official and sent, it is transferred to the sector official as shown in **Fig. 17**. When you click on the review button, it will appear. All transaction information and all requirements of this section are completed as shown in **Fig. 18**.


**Fig. 17.** Sector Administrator interface.

**Fig. 18.** Administrator Section Review Interface.

## 13. Tax Official Interface

The tax department is one of the departments of the department that is in the fourth sequence of transaction steps. When the information is entered and completed by the sector official and sent, it is transferred to the tax official as shown in **Fig. 19**. When you click on the Review button, it will appear. All transaction information, and the responsible employee work to accomplish all the requirements of this section, as shown in **Fig. 20**.

**Fig. 19.** Tax Administrator interface.

**Fig. 20.** Tax Administrator Section Review Interface.

## 14. Final Auditor Interface

The final auditor section is one of the departments of the department that is in the fifth and final sequence of transaction steps, where when the information is entered and completed by the tax official and sent, it reaches the final auditor official as shown in **Fig. 21**. When you click on the Review button, all the information will appear. The transaction and the auditor fulfill all the requirements of this section, as shown in **Fig. 22**.

**Fig. 21.** Final verifier interface.

**Fig. 22.** The audit interface for the final auditor.

## 15. Interface for Creating an Account for the Citizen

One of the first steps that a citizen takes to register with the department is to create an account for him, and this is done only once. When performing another transaction, he should not create a new account because he has registered with the department previously, as shown in **Fig. 23**. When you click on the registration button, the account registration in the department will be completed and moved to the main interface for the citizen, as shown in **Fig. 24**.


**Fig. 23.** Interface for creating an account for a citizen.

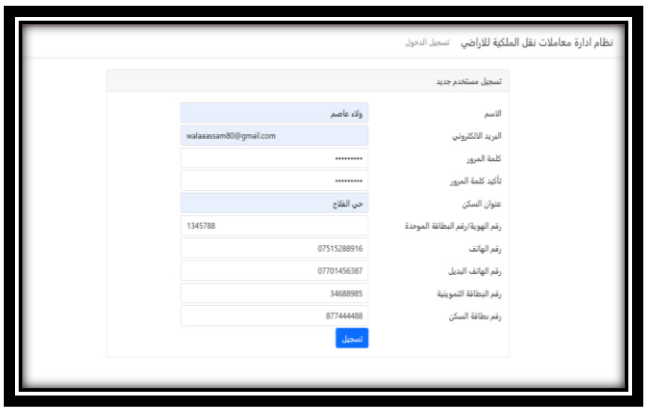


**Fig. 24**. The main interface for the citizen.

## 16. Features of the proposed system

After the proposed system was tested, it was noted that the system is characterized by the following:

1. The method of logging into the system is smooth and easy
2. The citizen registers the request in his own interface, and each employee in the department has a separate interface, independent of the employee interfaces, giving privacy to employees working in the department.
3. The confidentiality of the information enjoyed by the system, as no unauthorized person can enter the system, and thus all information is protected
4. A significant difference was noted in the effort of those working on the system, which saves them time and effort and facilitates conducting operations and completing procedures in every section affiliated with the department.
5. The system has clear interfaces specific to each user of the system, which are organized according to the type of user, ease of use, coordinated colors, and the way the buttons are named according to the tasks required of them.

## 17. Conclusion

After completing the stages of developing the system in terms of analysis, design and implementation, the system was tested to ensure the correctness of its work, as registration was made in the Real Estate Registration Department within the electronic platform to transfer ownership of a specific land and after entering all the information required from the citizen, the citizen has the ability to follow the status of the transaction and the process. It is transferred from one department to another, in addition to informing the citizen of all the fees required of him without the hassle of going to the department. Thus, the proposed system reduces the time and effort expended by the citizen. At the same time, the transfer of transactions between relevant government departments has become easier and more efficient than the traditional paper system, which has saved the employee a lot of time. The system has also contributed to preserving transactions from damage. The system also guarantees the confidentiality of information about lands and their owners. The use of diagrams for the system analysis and design process supported by the Unified Modeling Language contributed for laying the foundations of developing the system according to correct scientific concepts. The use of modern programming languages and tools was also reflected in the professional development of the system interfaces, which provided flexibility and ease in dealing with the system interfaces, in addition to implementing the system according to the concept of distributed systems using the chrome web application. greatly helped in collecting information in each section of the department quickly and issuing final reports in a timely manner. The method of designing the interfaces of the employee departments in the department worked to preserve the confidentiality of the information and limit it to the system administrator and administrative authorities only.

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