OPTIMIZING MATERIAL FLOW IN COMPANIES THROUGH INTEGRATED DIGITAL SOLUTIONS

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ABSTRACT: This article presents FluxManager, a web-based platform designed to optimize the management of material flow within a company. The platform combines two complementary solutions: a company presentation website developed with Webnode and the core application hosted on CloudDNS, which supports PHP code and a MySQL database managed via phpMyAdmin. FluxManager enables the online management of material orders for various projects and operations, by having implemented three distinct user roles with specific access rights: the project responsible, who can track their own orders and statuses; the acquisition department, who has access to all orders and users and the warehouse department, who monitors incoming orders and identifies completed orders delivered at warehouse or directly to project sites. By providing a centralized digital solution, FluxManager enhances operational efficiency, improves order tracking, and ensures transparency in the material flow process.

KEY WORDS: material flow, digital platform, web-based application, operational efficiency, order tracking.

1. FROM DESKTOP APPLICATIONS TO WEB-BASED PLATFORMS

Empirical evidence from numerous companies indicates that traditional record-keeping methods—such as Excel spreadsheets, printed forms, or informal discussions—remain in use. While these approaches may suffice in limited contexts, they tend to become inefficient as data volumes increase and more personnel are involved.

Advances in digital technologies have profoundly influenced how companies organize their activities, generating a growing need to automate internal processes. When selecting a management application, companies consider not only technical performance but also cost, ease of use, compatibility with existing systems, and employee expertise. Consequently, many small and medium-sized enterprises still rely on desktop applications. Although these applications lack modern features such as online access or cloud integration, they provide stable, accessible solutions that comply with local legislative requirements [4,11].

Desktop applications continue to play a role in material flow management, particularly in organizations with legacy systems or stringent security and performance requirements. Such

applications offer offline functionality, enabling faster data processing and enhanced data security. They also integrate seamlessly with local hardware, including barcode scanners, RFID readers, and industrial printers [8].

The emergence of web-based platforms has addressed the growing and diverse requirements of modern companies. Internet accessibility, cloud technologies, and programming languages such as PHP, JavaScript, and Python have enabled the development of online applications that operate in real time without requiring local installation. Web platforms support efficient management of administrative and operational processes, providing rapid access to information, transparency in operations, and collaborative functionalities for geographically distributed users [2,5].

Currently, various digital platforms are dedicated to material flow management, each with distinct features and underlying technologies. Notable examples include Inpixon RTLS Platform, which employs Real-Time Location System (RTLS) technology; Blue Yonder, focused on supply chain planning at the macro level; Nexus Connected Worker by Hexagon AB, designed for shop-floor workers; Kardex Control Center, for automated storage systems; mScales, a cloud-based solution for digitizing material weighing; and Master Data Analyzer Vision by SICK AG, a rapid data-capture system for optimizing storage and shipping. Each platform offers advantages and limitations, often tailored to specific domains or operational needs.

The FluxManager platform, developed for a company in the electrical engineering sector, addresses the collaborative monitoring of material orders required for project execution. It provides end-to-end tracking of orders, differentiated access for various user roles, and full traceability of all operations performed.

By combining standard web technologies, such as PHP and MySQL, and modern ones, such as CloudDNS and Webnode with role-based functionality, FluxManager delivers a flexible, cost-effective, and easily deployable solution for managing internal material flows.

2. FLUX MANAGER WEB-BASED PLATFORM

For the development of the FluxManager platform, two complementary solutions were used, each having a well-defined role in the final structure of the application.

For the implementation of the company's presentation web pages, Webnode was employed, enabling the creation of a user-friendly interface that provides general information about the company and, through an intuitive menu, allows access to the order management application developed specifically for the company.

For hosting the application that manages the material flow, CloudDNS was used, facilitating the execution of PHP code on a MySQL database configured and administered via phpMyAdmin.

This approach provides a clear separation between the presentation layer and the functional core of the application, improving the efficiency of the development process as well as enabling independent testing and modification of each application segment.

The software tools employed do not require costly licenses or complex, dedicated server configurations. The application doesn't imply local installation and doesn't use significant hardware resources.

2.1. Web-platform design

Figure 1 illustrates the navigation flow of the FluxManager website, developed using the Webnode platform. The main page is divided into three sections: Home, Projects, and Orders, each with its own specific submenus.

The Home section provides information about the company's management, the services offered, and contact details, giving visitors an overview of the company's activities.

The Projects section contains a photo gallery of the company's completed works, contributing to the creation of a visual identity and strengthening trust in the services provided.

The Orders section includes the View All Orders button, which redirects the user to the FluxManager application.

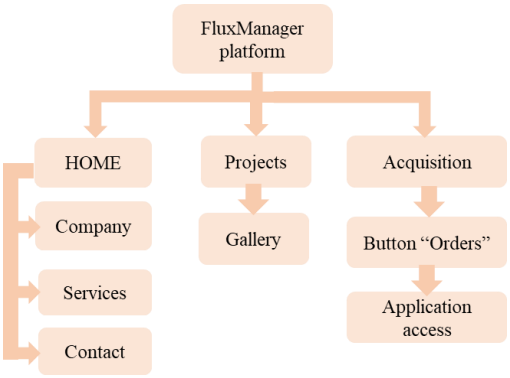

Figure 1. The structure of FluxManager platform

For the front – end of FluxManager, the flow diagram shown in Figure 2 illustrates the operating mechanism of the application, starting with the authentication process and continuing with the distribution of functionalities for each user role. Depending on the account used, the application directs the user to the interface corresponding to their specific role, with each category being assigned particular rights and functionalities.

The Project Responsible role has access to the order placement form, can view only their own orders, and can track their status across all three stages: placed, in progress, and completed.

The Warehouse department role has access to all existing orders within the platform corresponding to the location in which they operate, regardless of who placed them, and can change their status from in progress to completed.

The Acquisition department role has extended access to all orders across the company's three locations, can manage users, edit or delete orders, view company-level statistics, and modify any element within the system.

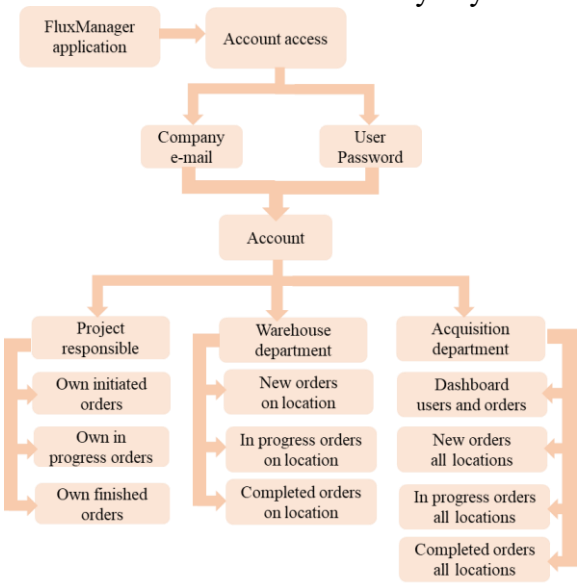

Figure 2. The flow diagram of FluxManager application

In the back-end lies the database which consists of 10 tables containing data for each location and each order phase, as well as for application users, according to figure 3. The database is designed to be scalable and adaptable to future extends and company needs.

The application is developed in PHP, and the connection to the database is established using the mysqli_connect() function, which requires the server name, username, password, and database name for authentication. Once the connection is established, data can be retrieved from or sent to the database using SQL queries. These queries are directly integrated into the application's scripts to enable functionalities such as displaying orders, saving new orders, updating their status, or authenticating users.

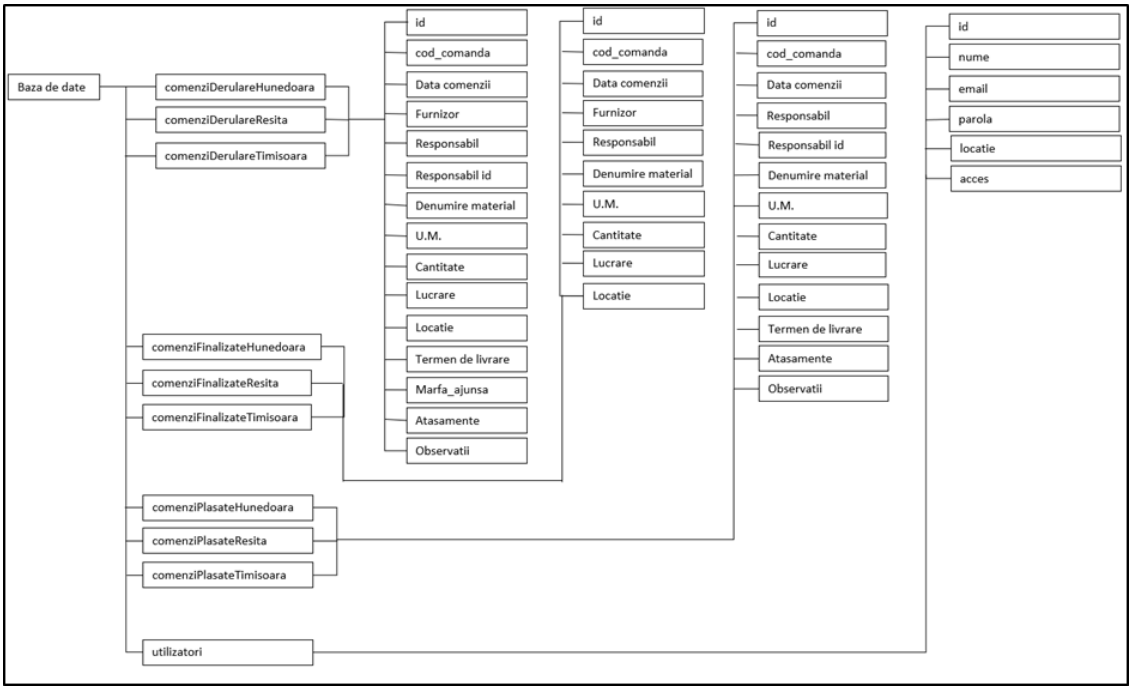

Figure 3. FluxManager database design

2.2. Web-platform implementation

For developing the application of the web-platform PHP and MySQL languages were used, together with phpMyAdmin administration tool and CloudDNS for hosting. The PHP programming language is a widely used server-side scripting language particularly suited for web development [7]. In the development of the platform, choosing PHP allowed for rapid iteration of server-side logic, such as handling user roles, order workflows and database interactions, and broad support in web hosting environments [12].

MySQL is an open-source relational database management system known for its performance, reliability and wide adoption [6, 10]. In our platform, MySQL was used to store and manage the material orders, user roles, status updates and project metadata—offering a familiar SQL interface, robust support and good scalability for the expected workload.

phpMyAdmin is a web-based administration tool for MySQL (and compatible databases) that provides a user-friendly interface for database design, queries and maintenance. phpMyAdmin facilitated the configuration and administration of the MySQL database, tables, indices, user rights, thereby reducing the overhead of manual SQL scripting and speeding up the deployment of the database schema and maintenance tasks.

Using a cloud-based hosting environment (for example via CloudDNS or equivalent managed DNS/hosting services) enabled the application to be accessible online, with scalable infrastructure, high availability, and reduced dependency on on-premises servers [1, 3]. For instance, cloud DNS services provide features such as global anycast, failover, GeoDNS and API-based automation [9]. Hosting the core application on a cloud-enabled infrastructure allowed us to decouple from local hardware, facilitate remote access by multiple user roles and support future growth of the platform.

The main page includes a structured menu containing information about the company, the completed projects, and a section entitled Orders. This section features a button labeled View All Orders, which directs the user to the FluxManager application hosted on CloudDNS, specifically to the login page, where the actual interaction with the application begins. The index.php file receives the login data and validates it against the users table. The database connection is configured in the config.php file. The authentication query source code corresponding to index.php, as

shown in Figure 4, redirects the user to the page associated with their assigned role.

```php
$email = $_POST['email'];
$parola = $_POST['parola'];

$stmt = $conn->prepare("SELECT * FROM utilizatori WHERE email = ?");
$stmt->bind_param("s", $email);
$stmt->execute();
$result = $stmt->get_result();

if ($result->num_rows === 1) {
    $user = $result->fetch_assoc();
    if (password_verify($parola, $user['parola'])) {
        $_SESSION['username'] = $user['nume'];
        $_SESSION['sediu'] = $user['sediu'];
        $_SESSION['user_id'] = $user['id'];
        $_SESSION['user_email'] = $user['email'];
        $_SESSION['acces'] = $user['acces'];
        session_regenerate_id(true); // Prevenire session fixation

        if ($user['sediu'] == 'Timisoara') {
            header("Location: comenziPlasateTimisoara.php");
        } elseif ($user['sediu'] == 'Hunedoara') {
            header("Location: comenziPlasateHunedoara.php");
        } else {
            header("Location: comenziPlasateResita.php");
        }
```

Figure 4. Source code for authentication

The source code shown in Figure 5 is used to display the most recently registered orders on the platform for each of the three phases: placed, in progress, and completed. This process is achieved by executing SQL queries that extract the most recent data from the tables corresponding to each status, using SELECT statements combined with UNION ALL. To differentiate the orders originating from various tables, each subquery includes an additional column named type, which indicates the data source, thereby enabling clear identification of both the location and the status.

```php
$orders_placed = $conn->query("SELECT * FROM (
    (SELECT 'plasate_resita' as type, id, Responsabil, Cantitate, Locatie FROM comenziPlasateResita ORDER BY id DESC LIMIT 5)
    UNION ALL
    (SELECT 'plasate_timisoara' as type, id, Responsabil, Cantitate, Locatie FROM comenziPlasateTimisoara ORDER BY id DESC LIMIT 5)
) AS combined ORDER BY id DESC LIMIT 5")->fetch_all(MYSQLI_ASSOC);

$orders_in_progress = $conn->query("SELECT * FROM (
    (SELECT 'derulare_resita' as type, id, Responsabil, Cantitate, Locatie FROM comenziDerulareResita ORDER BY id DESC LIMIT 5)
    UNION ALL
    (SELECT 'derulare_timisoara' as type, id, Responsabil, Cantitate, Locatie FROM comenziDerulareTimisoara ORDER BY id DESC LIMIT 5)
) AS combined ORDER BY id DESC LIMIT 5")->fetch_all(MYSQLI_ASSOC);

$orders_completed = $conn->query("SELECT * FROM (
    (SELECT 'finalizate_resita' as type, id, Responsabil, Cantitate, Locatie FROM comenziFinalizateResita ORDER BY id DESC LIMIT 5)
    UNION ALL
    (SELECT 'finalizate_timisoara' as type, id, Responsabil, Cantitate, Locatie FROM comenziFinalizateTimisoara ORDER BY id DESC LIMIT 5)
) AS combined ORDER BY id DESC LIMIT 5")->fetch_all(MYSQLI_ASSOC);
```

Figure 5. Source code for orders display

The application database is implemented using phpMyAdmin and SQL language. Its structure can be seen in figure 6. In order to have a better control over material flow data tables were built for each location.

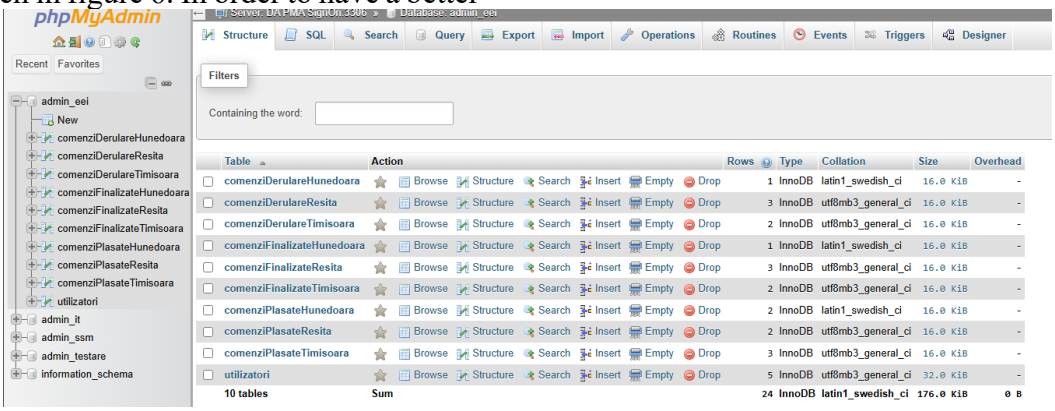

Figure 6. Application database built in phpMyAdmin

2.3. FluxManager functionalities

As mentioned above, Fluxmanager web-platform consists of two components.

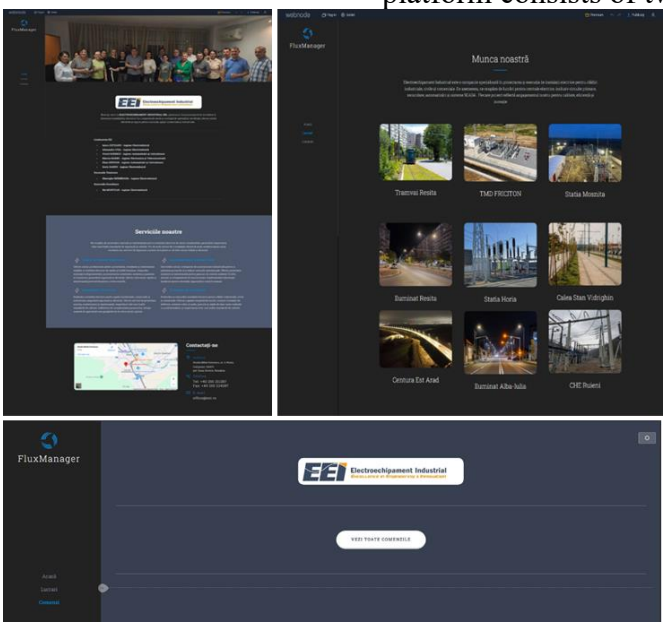

Figure 7. FluxManager website

First component a user accesses is the website, as seen in figure 7, which contains a page about the company, services and location, where Google maps component is integrated, a page with an image gallery presenting all the projects the company delivered, as well as the projects in progress and the page with the "See all orders" button which redirects the user to the FluxManger application.

Second component of the platform is the web application. After login, each user can see the data available for the type of role he has in the company. The Project responsible can access his own orders and can initiate new orders using the form shown in figure 8. After every order event the involved personnel is notified by e-mail concerning the status of the order.

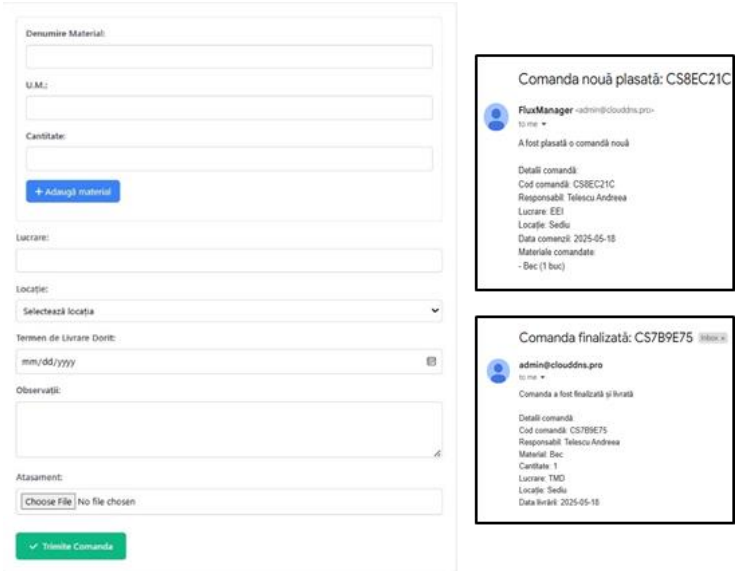

Figure 8. Initiating an order and status confirmation by e-mail

After an order is made by the Project responsible user, the order gets visible in the web application for all three types of users and can be processed. In the back – end the database is updated with the new order. The Acquisition department user can now take over the order and move it to "Processed orders" where he can set the delivery date, the supplier,

he can delete an order or move it to "Completed orders" if case. If an order is delayed, he is notified in the application by delivery date marked with red text (figure 9).

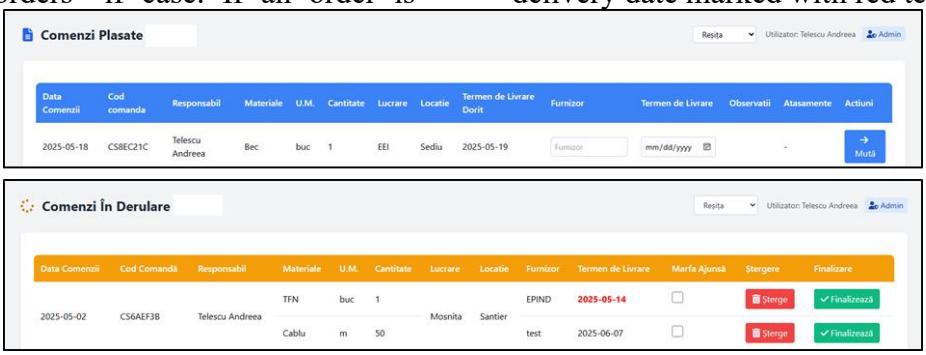

Figure 9. Order processing in FluxManager application

The Project responsible user has access only to the orders they have initiated. At each stage (placed, in progress, or completed), they can view only the orders initiated by him, ensuring clear organization and individualized control. The Project responsible user can track the status of orders, view the selected supplier, the delivery deadline, any comments entered, and the moment when the order was completed.

In the "Placed Orders" section, the Warehouse department user can view only their own orders. However, in the sections for "In Progress" and "Completed Orders", they can view all orders placed by users from their location. The Warehouse department user is authorized to move an order from the "In Progress" phase to the "Completed" phase once the materials have been successfully delivered on site or in the warehouse. In figure 10 is shown the view for each user type, according to the wrights that were defined.

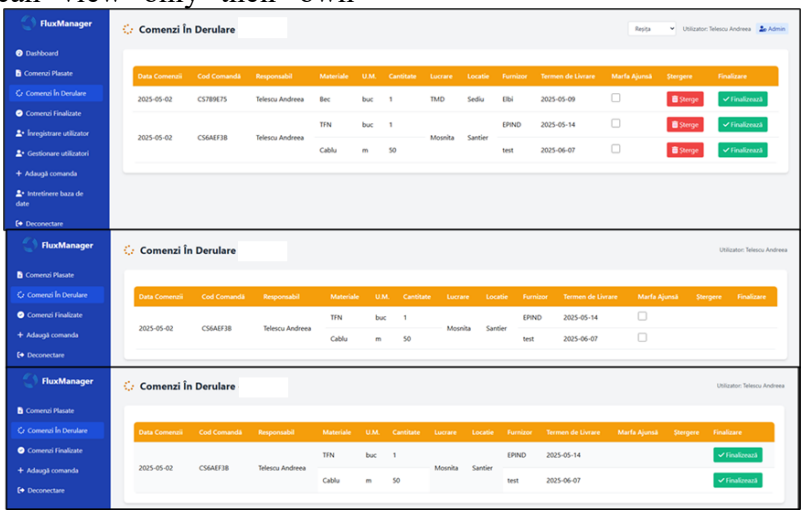

Figure 10. Order view for Acquisition department, Project responsible, Warehouse department

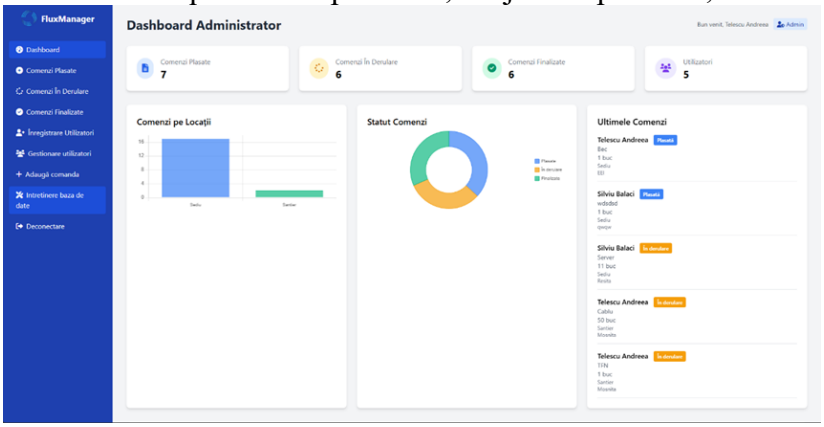

Figure 11. Dashboard statistics for Acquisition department

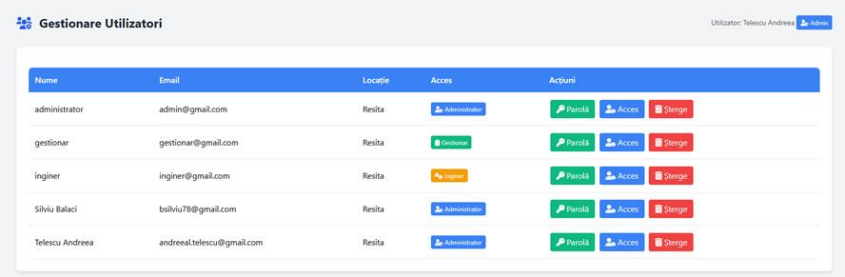

Figure 12. Users management for Acquisition department

The user with the Acquisition department role has the most extensive access rights. Through the Dashboard illustrated in Figure 11, this user can view all statistics related to orders and users, and can manage all orders at every phase across all company locations. Additionally, as shown in Figure 12, the Acquisition department user can register and manage users within the system.

3. CONCLUSION

FluxManager represents an effective and accessible solution for managing material flow within companies, providing transparency, control, and operational efficiency. By integrating standardized technologies and adapting to specific user needs, the platform differentiates itself from existing solutions and directly addresses common challenges in material management.

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