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# INNOVATIVE GUI FOR AUTOMATED CONTROL OF STORAGE PROCESSES

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**Abstract**— With the rapid development of technology in all areas nowadays there is a constant effort to introduce technological solutions in everyday life with emphasis on materials management information systems (Enterprise Resource Planning). The last few years the variety of these systems have been increased for small business or for SMEs or even for larger companies and industries. In the field of material management with automated processes, ERP applications have only recently begun to make their appearance. This thesis will present the development of a system for automated material storage process in a system built through specific roles that will manage materials using an integrated barcode scanner. In addition we will analyse and describe the operation and modules of other systems that have been created for the same usage. The object of research and development, falls to P.M.S since it deals with modern automation technology applications, we will attempt to construct an original application enabling better management of materials for usage and storage. The aim of this thesis is to create a prototype application that will be innovative with a flexible nature that will give solutions, with low cost, also it will be user friendly. This application will allow quick and proper materials management for storage. In the main part of the study will be an analysis of the programs used for creating the application, the capabilities and the way it works, we will also discuss the advantages and disadvantages and simultaneously propose optimizations to further extend the benefits of the operation. The expected result is that the application can be used by smart devices with android environment and computers without an external barcode scanner, making the application accessible to the buyer with low cost. The main aim of this project is to reduce the time required for registering and counting large number of products for transport and storage.

**Keywords**— ERP, Material Management, Barcode Scanner, Smart devices, Android

## I. INTRODUCTION

In the 21st century, an operation to survive and progress will have to be innovative in terms of production processes, products and services with ever-increasing frequency. If the company stays uninvolved and ignoring it is certain that in all means will lose a competitive advantage, see [1]. Over time as systems became necessary and most widespread to Greek companies and it has been seen the need to establish an information system which will be accessible to the user and will enable with cheap media like a smart device to allow a worker to manage large quantities of materials and register material details. In essence, the user has the option of having a daily use because the phone device can perform operations that would otherwise require a desktop computer accessories and software with much greater value and provided the limitation of a particular work space by removing the freedom of movement in other workplaces that are not easy to install on an office.

Information systems developed by systematic Gallery after researching many scientists belonging to different scientific fields. It all started in the mid-20th century when scientists reached how each object may be part of a larger whole. So one entity while maintaining the importance that had become index of the larger whole where it belonged.

## II. METHODOLOGY AND SYSTEM STRUCTURE

They have given various definitions of ERP systems one of them said in the article of Wailgum on «ERP Definition and Solutions» and successfully approaches the concept of an ERP system. Specifically, it identifies those systems as an attempt to integrate all departments and functions of a company



in a computer system that can serve the specific needs of all segments as in [2].

In this paper, the ERP system that will be analyzed belongs to the Storage subsystems-distribution and procurement. ERP systems often encounter obstacles, as many businesses have made in the past and note even today failed or came up against various problems in trying to implement these systems. The difficulty of dissipating an ERP system combined with the high costs make it necessary to build a system with a low cost, and with an easy-to-use interface which can provide solutions to specific subsystems.

The system will be designed for use by specific categories of people who are depending on their location will be provided with specific features for the optimal management of the materials whether it be in the workplace or in a storage room or even from their home having only as necessary via a smartphone by forcing the cost components for recording and storage such as a barcode scanner and a computer.

Essentially there will be the possibility of creating materials for their entry into a database so they can be sent over a network to a central server which can complete the placement process and views of warehouses and the materials that are in storage in list format. There is the possibility of individual application function autonomously which will manage materials based on the study and the needs of companies that use an operation ERP systems that require the display of materials properly structured with enough details giving flexibility to the application administrator and enough information for the proper management of stocks by preventing late tasks if the warehouse lack of materials.

After the necessary survey it has been observed lack of smart device application that has integrated barcode scanner. For the creation of this application it has been designed and cite the relevant characteristics that can cover this program. The functional characteristics that they should be included is a barcode scanner and an application which can store and work as a mediator in between the ERP system and portable on the server. The features of the program were based on the logic of a business which has a specific hierarchy. To cover this hierarchical class of company it is important to design four key roles for the application.

The reason for the need of the barcode scanner embedded in the application is to allow company employees to have a quick registration materials in the system and allow the managers to keep abreast of the materials that are in stock of the company.

Then materials should be stored in a virtual warehouses and for educational reasons we made posts to check the proper storage and management of materials. Also for connection of the various devices between them it was necessary to have some form of online transfer. The online transfer that it has

been created for the connection of the devices is the File Transfer Protocol see [3].

To build the application it was necessary to choose program for the development. The Unity Engine is used as code development system of Visual Studio in which it has given professional opportunity in developing code. This allowed us to create using C sharp code within the context of Unity. The unity strengthened the visual Studios giving export to multiple platforms, also it has internal system graphic environment in two dimensions which were necessary for the development of our application. At the same time using the online features of c sharp gave us access to a large number of online services which could meet the online needs of our application. Furthermore the Unity allows the user to use a camera which was very important to develop the function of barcode scanner. For these reasons the chosen program for the creation of the application was Unity Engine see [4].

The design and creation logic of the information system have been created with the knowledge and structure of the science logic design. The science of design developed in 2004 when two researchers used the benefits in computer information systems. Essentially proposed a model that carries the research design an application on a simple methodology, otherwise routine. This model starts with a simple stage i.e. the Awareness of Problem, which can be analyzed having in mind the objective that aims to create the application.

The next stage is the stage of the proposal at this stage they used the existing knowledge in order to develop solutions that can complete the needs of the system. The main point of the analysis is the part of "Suggestion" because the functionality of the system is determined by the initial and current application. Then there is the "Development stage" at this stage they recommend a solution as a mean of temporary solution and then afterwards we search comparison against alternative solutions which meet this problem.

As you follow the order and complete the steps above and find a solution to the problem than you can continue to the development of the application and then rich the point of the "Evaluation". The evaluation results provide information feedback and can improve the planning process and the quality of implementation. The final stage of the "Conclusion " indicates the end of a cycle of research, namely the expiry of a certain study. Additional iteration is possible from the stage "conclusion ", however this is guided by the objectives as in [5].





The application consists of four main roles, each role has specific abilities, and some of them have common features and some other unique features.

In the system will be the (Administrator) that can create, delete users and modify their accounts, also he will be able to see the number of users in tabular form as well as to amend the registered details such as Name, Username, Password, Role. Then there will be the role of the (Senior Manager) who initially will have access to the application, also he will have the ability to check the stock of the central warehouse, also he will be able to check the materials locations, team, workspace and transferred materials as for example in a plane which has been send for repair if we refer to aircraft crew. Furthermore he can oversee the transport of material history and finally he will have the ability to accept requests to order materials or may approve materials for order.

A more essential role is the (Manager) of the project who will have access to the application, he will also be able to send requests for materials or order goods from the central repository, then he will have the ability to check the stock of the local warehouse but also each workspace that have transported materials. Another feature that the manager will have is the inputs of the details of the materials that will be made in three ways through the application. The first way is the barcode scanner which will have the capability to add materials on the system if the material is new to the system manager will enter the number and it will be registered or added like stock, the other way would be to record the material in a form which will appear giving the option to record the essential characteristics of each material. Finally there will be a search tool that finds through any attribute the material, with no need for the user to add more information. Also manager will have the option to remove materials that were taken from the warehouse supervisor or spent in the workplace that are needed for use.

The fourth and final role for the proper functioning of the system is the role of the (worker), who depending on the location will have access to the application through the appropriate profile. Also the worker can make material entry as a manager but only for the warehouse that have been assigned. The above limitation will be done automatically when the user creates the account and his role to the system. Finally he will be able to remove the materials that were spent or sent for the needs of a repair.

The administrator have been created for either the manufacturer of the application or the owner of the company to be able to control, to adjust and delete users by giving them a role in business-company controlling and defining in a closed system the capabilities of each user. Based on this logic on the interface of the admit it has been discern with the entrance of the system four buttons " functions ". As the user

can see in figure below (see Figure 1) the administrator has the ability to add users (Add User). Also he has the ability to configure existing user accounts (User Modify). Yet the administrator has the option of a partial deletion of user information or total delete. Finally there is a button that can log out the users from the system.



Fig. 1: Administrator environment upon entering the system

As the administrator selects the command Add User he can notice the changes of the virtual environment where distinguished the input field that the administrator can enter the user name, the name of the application code, " Username ", and the secret code for the introduction of the system (see Figure 2). Also it has given to him the choice to give to the user a specific role. The roles that can be selected by the Central administrator for a new user that will be register to the system are Second in hierarchy Manager, " Admit " Secondary, Director, " Senior Manager ", Warehouse Manager or department head, " Manager ". Finally there is the role of a warehouse worker, " Worker ".

Each role has a connection between them giving different abilities of each user account in a controlled environment so they can process and manage the fields that match every time to the users roll in the company.



Fig. 2: Environment for adding a user

Fig. 3: Environment for Modify and Delete user

With the logic of adding user there is also the option of removing a user. For the delete of a user admin must first search him by simply pressing a characteristic that specifies either the name or code name, recalling the elements of a user and with a simple click of the delete, (see Figure 3), the account is removed from the system and automatically is prohibited to the user to log in for any means of entry into the system. Deleting users is necessary for reasons of staff erasers, removing the rights of the user from the system.

Because the system has a vibrant enterprise which has either crowd or a number of workers definitely it is needed to be able to change user information as well as to change his role. This possibility is given to the Administrator by clicking Modify user, (see figure 3), giving him the opportunity as before by calling users name or users username for modifying and changing field or his role. Finally there is the exit button, "Exit" for the administrator to disconnect from the system, protecting user information. If the administrator is not logged off within a minute of no use the application then automatically logs outs and shows the user the initial introduction screen. This automation has been created for all users for privacy reasons.

Finally the admin has the capability to check at any time the number of users and aggregate items feature by clicking on the View users, "Users" View, seeing a table to order all information of users who have registered in the system, that is, User Role Name and Code name (see Figure 3). By closing the Panel he turns back to the main screen of the Administrator. Every time the administrator change an attribute of the user than automatically the system change his abilities and roll and also the characteristics in the panel like we have seen a key feature of as mentioned above.

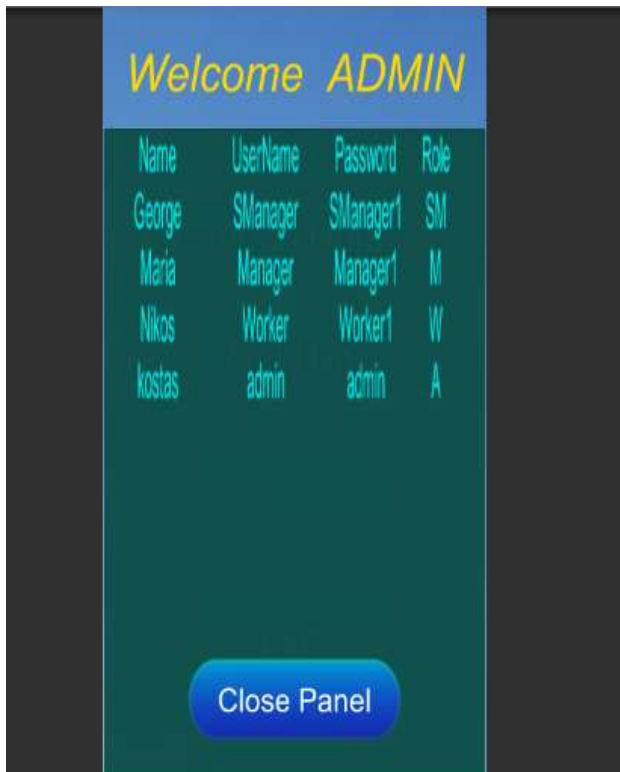


Fig. 4: Users Panel



Fig 5: Senior manager as he enters to the system

The Senior manager like his role in the companies is necessary and essential for the correct operations, procedures and management that need oversight responsibility. In this application the Senior Manager has a very important role that makes him necessary for the proper functioning of the information system.

As seen in the figure below (see Figure 5) the Senior Manager has the option of selecting the button "View Warehouse " and by selecting from the drop down box the virtual warehouse that he wants to see the stored materials within he can supervise. This option gives the ability to the Senior Manager to audit at any time if the material has been posted on the schedule post, registered and which user was posting. The Panel which appears to the Director is the following (see Figure 6) and essentially can check at any time if the materials are available in a specific location, giving him the ability to know when the warehouse will run out of stock.

Also the senior manager has the ability to register a new repository in the system giving access to the Manager automatically and possible license to the Worker role if the field of his work is in this new warehouse. An option that is designed for the system that makes it special is the Senior Manager's ability to create warehouses which in essence could be and workplaces (work fields). The logic of this feature was designed upon research and personal experience in the workplace such as ships and aircraft. For example when an engineer on the ship repair industry is sent to repair a particular area of the ship whether for engine control panel, plc and generally anything related to machine is required by the competent ship engineer to check by using the manufacturer's manual to computer repair costs, thus giving the opportunity to the scholar to know when a large percentage of the number of materials that will be needed to repair the damage. The Senior manager may have the program for the repair of the damage and he can ask to a warehouse officer an accurate study of the choice of materials that will be needed to repair the damage by entering in a new warehouse with the code name of the ship ordering the exact materials the engineer will need for the repair.



Fig. 6: Simple example of posted materials in a warehouse

The same procedure can be done in any job which requires materials that are predefined, this way by charging the employee with these materials render him the responsible "Warehouse Manager". The benefits of this temporary location that can only create the Senior Manager make his role too important for the information system like his role in the company. Essentially it has given to the senior manager a continuous supervision of the repair after the daily work of a worker to check the materials that have been removed for the repair of a work and he will know who, in the exact moment, place and time have taken materials and from which warehouse have been taken by the information system. In this way, the warehouse manager will know at all times the progress of repair and if the study had made responsive to the needs of the repair.

Finally the senior manager has the ability to receive messages through the system which will be received in text message format enabling over the network and without any additional fee to the users to be able to communicate with him. The reason this feature has been created is because many times employees don't have the opportunity to communicate with the person in charge of system. This way enables users to ask or point out some information which is good for the Senior Manager to know. Primarily this option was created to allow the warehouse manager or the employee to inform the senior manager for the end of the stocks of a material because the application does not have yet automatic supervision.

The most important part of the application and the most interesting was to design and manufacture the functionality that has been built into the warehouse officer make him number one with huge difference. As the Director of the warehouse manager has the access to see all the locations, as it seen in the figure below (see Figure 7). The warehouse manager has the option of selecting the button "View Warehouse" and by selecting from the drop down box on the virtual warehouse which warehouse wants to see the stored materials within it that he can supervise. This option gives the ability to the manager to audit at any time if the material is been posted on the schedule post, registered and which user has post the material. The panels that appear in the screen of the warehouse manager are the same with the Senior Manager and they are the same as above (see Figure 6). Manager with that feature can essentially check at any time if the materials are available in a specific location to monitor giving him the capability to know when and which warehouse had run out of stock.



Fig 7: Environment of Manager, Option of the warehouses for inspection

Then as the user can discern from the scenic environment the command "Add to" by selecting one of the existing



warehouses the warehouse manager is able to add materials and register basic information.

The first thing that appears in the user after choosing to add materials are the following graphical interface, (see Figure 8) a barcode scanner appears enabling the user from his device to register the barcode of a product with the usage of the camera from the device without having any other via.

If the material is already in the data base the product with barcode number corresponding the number posted at the moment the system automatically revokes its elements and the user without further moves can add directly to the warehouse the number of materials he received in the warehouse. The other way to check if the material is registered in the database and the warehouse is to write the name to the Input field NAME /BARCODE giving the knowledge to the user to know if there is a Barcode Number for adding the material in the database by writing the data to the form. If the product already exists then you can directly add or subtract the number of materials to receive the departure.

When the material does not exist to the data base and generally it is the first time the systems recognize this code number then the user by selecting the tick button is transferred in a form that must register basic principles of product information (see Figure 8). The user must set the name of the product (Material Name) and automatically covered the field of barcode number with the number that has been registered by the scanner, then you need to set the product's position (Position) in the warehouse.

At this point it is important to make clear that the position of the product in every business is changing, some warehouse may have large closets and be able to store small parts such as screws inside the shelves, dexion, in some other warehouse bolts can be stored in boxes which are on the ground. For the above reason that have been stated it is very important to indicate the place or position where the material have been saved or even better the code name of the respective drawers for example H2. 12 or any other code name the user wants. Then for archiving purposes it is very important that the supplier of materials can be supervised and purchased by the administrator as well as the capability off the user to inform at any time the warehouse manager with a message when there is lack of a product. This field can be improved in a future upgrade of the application where the system will automatically order materials which are below the desired threshold stock.

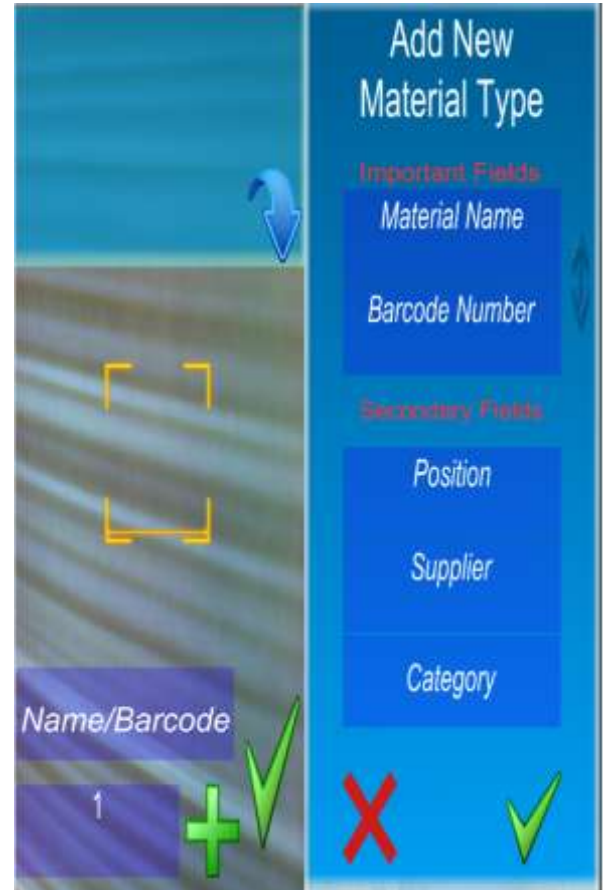


Fig. 8: Barcode Scanner, New material fields

It is very important to register materials, category for the save. At this point it must be noted that there is the possibility for the user to set a code name which will make it easier for users of the application and the workers of the warehouse to search for an encoding class material such as adhesives, for example, with the code name c.

Completing the introduction of necessary input fields and preferably the second field in the user can complete the product registration in the system and then add materials depending on the number of the stock.

Warehouse officer also has the ability to send messages to the Administrator and the Senior Manager through the system that sends text-formatted message giving the capability over the network and without any extra charge for the users to communicate with each other. The reason this field have been designed is because many times people do not have the access to communicate with the person in charge of the system. This way enables users to ask or point out some information which is good for the heads of the system to be known. Primarily this option was created to allow the warehouse manager or the employee to know the end stocks of a material because the application does not have automatic supervision.



Also warehouse operator is necessary after each change in the program to send the changes to the central server because updates are automatically saved but not sent automatically to the host (server). To perform this synchronization it is necessary for the user every time he does a conversion to the number of materials to select and click the Upload button passing through to Internet the files in xml format. Finally the last role of the system is the role of the worker. In essence the worker has some common features with the warehouse officer giving him the access for certain procedures. Originally the worker cannot choose warehouse for details but only the details in a specific location that is specified by the administrator, thereby this restriction reduces considerably his freedom to the application. All the other capabilities of the worker are the same as managers. He can scan materials like we mentioned above and either add or remove them, also he can sent message to the manager, senior manager and Admin for any problem that he has observe and need to ask for guidance. Finally worker is able to save the changes he does to the warehouse like manager.

For the manufacture of animation that the user can observe in the application when the user opens the applications from his device he can see at the home page the application logo bouncing around as well as the introduction of material that the user has the option at any time to see the material that adds that moment by clicking the arrow in the top right. This move that Panel does is a combination of code and a flowchart that were constructed from the Unity Engine and enabled those movements.

The logic through the diagram is to enable the creation of structure analysis of motion (see Figure 9). To achieve correct movement it is essential to declare the original location of the panels or the logo in this case and subsequently had to define the locations where you want to shift depending on the moves that you can set manually by the design environment of the application. It is important also set to the system an external factor which will affect the application and the way this factor will define the system. For example with a " hit " to descend the panels one hundred percent while with two fast " hits " to descend half Panel that is fifty percent. Finally, depending on the position either to revert to fifty percent or come back to the original post.

The figure hides inside a true and false statements that are affected as the darts of the flow chart shows to the image below, it is obvious that a simple move hides a little more complex logic but the possibilities Unity given to the designer are countless and are limited only by his imagination, knowledge and time that can be allocated to improve the graphical interface of the application. Certainly the Unity Engine because it is a construction program for games and applications gives to the user endless possibilities that can

improve a GUI to enormous levels and it is certainly original for a modern graphical environment.

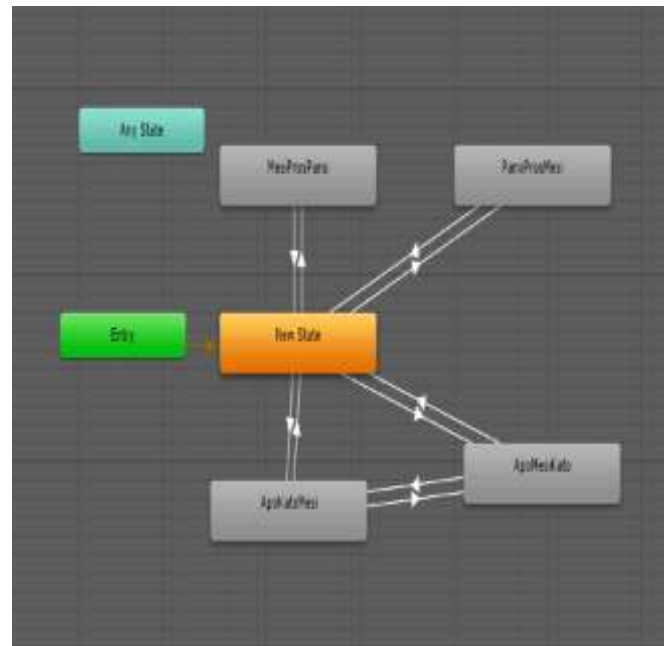


Fig. 9: Flow chart for Animations

The Research model, offered by the Wixom and Todd (2005), which incorporated both models (TAM, IS success) in theoretical and conceptual framework.

### III. CONCLUSIONS AND POSSIBLE IMPROVEMENTS

After completing the program some weaknesses have been observed in the system which could be corrected in the future. Initially it is noted that this application was constructed for academic reasons in a short period of time and as a result there are some problems that will be mentioned below.

Firstly manager section in the application certainly has room for improvement in various areas such as sending email to users for changing passwords periodically, also users could gain requests and messages from users for any possible reason that can be associated with the administrator, also the administrator must be able to temporary ban, " Suspend " users for reasons of violation and general security issues. Yet another area that can be optimized is the graphic interface of the Manager and in general the entire system. However for the needs of the system because it has been created for the diploma thesis the Administrator meets the basic requirements of control and user management.

The field of the application with the senior manager clearly has room for improvement as the system could enable the



Senior manager to know when the user posted the materials, the accurate date and time and from who user. So far the system knows who and when the changes to the material details did but there is no logic to the system that displays in graphical admin interface this information.

Still a future upgrade that could make our application smarter would be the ability of the Manager to designate a minimum stock and when it reaches the minimum desired limit automatically to inform the warehouse manager to order materials before the minimum limit. Also if the manager could designated certain suppliers the system could send a text message to each supplier that has been registered to the database there e-mail or the phone numbers and the system could inform them for the order and the date they must sent the materials that the manager thinks that the warehouse must have to the company. Then it is necessary to mention that the users at this level every time they change a material attribute with the current application in their warehouse or in the database they have to choose the Upload button, otherwise all the changes they have made will be stored on their device and not on the host server. This drawback has been detected but it doesn't fixed because it wasn't our prime purpose for the application to synchronize with a central server just during construction and after studying another information systems came on line the need for system synchronization.

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