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SMART WAREHOUSE AND INVENTORY MANAGEMENT SYSTEM

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Abstract— In general, warehouses are places where goods and products are stored. But the process of managing and locating goods in warehouses is difficult and moreover time consuming, this is because the user has to search the rooms manually and the allocate new places in the room when the goods arrive this requires a lot of effort. This process can be made more efficient using IOT. The warehouse management system uses sensors and QR codes to make this process more efficient. The goods are identified using QR codes and scanners and then can be allocated to various locations in the warehouse. This warehouse management project is based on the architecture of the internet of things which can be developed to track the products along with the product information. In this system a raspberry pi is used as a central server that monitors all information of the goods and using SQL the database is managed so that the user can track the arrival and discharge of the products and goods. This system is developed in a manner where it can be used with any existing warehouse inventory.

Keywords - Warehouse and Inventory management, QR code, barcode, IOT, Raspberry pi, SQL database

Introduction

Inventory management is one of the most important aspects while running a product-based organization. The current inventory management system though it works fine it is not efficient as it requires manual work done by a user to allocate space and record the sale and arrival of goods and products. This takes up valuable time that can be used elsewhere to be more productive. It also becomes difficult for the user to locate the product when it is necessary and takes up time to find the goods in the warehouse.

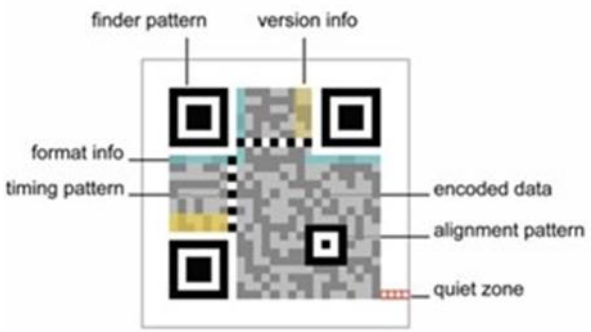
The inventory management system in this paper increases the efficiency of the management process and also makes the whole system work in a seamless manner. A raspberry pi acts as a central server that monitors all the information on the goods and keeps a record of the goods through SQL database. Each package is given a QR code which allows the scanner to get information about the goods and save the data to the database. Customer demands are never constant; it always varies. The frequency of goods is classified into 3 parts fast moving, slow moving and non-moving. These data can be analyzed so that the inventory can be planned in the most appropriate and optimal way. And also, the products can be sorted in an optimal way such that the fast-moving goods are placed in an easily accessible location in thewarehouse.

The information of the product can also be used so that the products can be classified into vital, essential and desirable products. Using all these methods the warehouse inventory can be managed in a very organized and efficientmanner.

A. Working of barcode system

Computers understand 0 and 1, hence while scanning if it reflects no light then it is considered as 1 & if light reflects then it is considered as 0. These are later grouped into 15 different sections out of 12 are used for numbers which are shown at the top in the above image. As you can see there are guards in the barcode image above (Left guard, Center guard & Right guard). Guards let the computer know where the barcode begins &ends.

QR codes are 2D matrix barcodes that are used in tracking and marketing for advertisements, magazines, and business cards. QR codes support four different types of data-numbers, alphanumeric characters, byte/binary information, and Kanji characters.



II. Related Works

[1] Samir Yerpude and Dr. Tarun Kumar Singhal, "Smart Warehouse with Internet of Things supported Inventory Management System", May 24th,2018

The objective of this paper is to study the potential of the internet of things when it is integrated into inventory management warehouses. The paper mentions multiple advantages of using the internet of things. It mentions transforming a warehouse into a smart warehouse. The solutions derived support the real time data gathering from the warehouse and get consumed in different data models to manage the inventory efficiently. The study further explains the current and future business scenarios along with the need for smart warehouses supported through the internet of things, hence converting any warehouse into a smart warehouse.

[2] B. Sai Subrahmanya Tejesh and S. Neeraja, "Warehouse inventory management system using IoT and open-source framework", February 19th, 2018.

In this paper, RFID is used for the warehouse inventory management system to overcome the difficulties faced in locating the products in the warehouse. The warehouse inventory management system architecture with the internet of things is developed to track the products attached to the tags with the product information and their respective time stamps for verification. The Raspberry Pi used here acts as a central server, which monitors all the information.

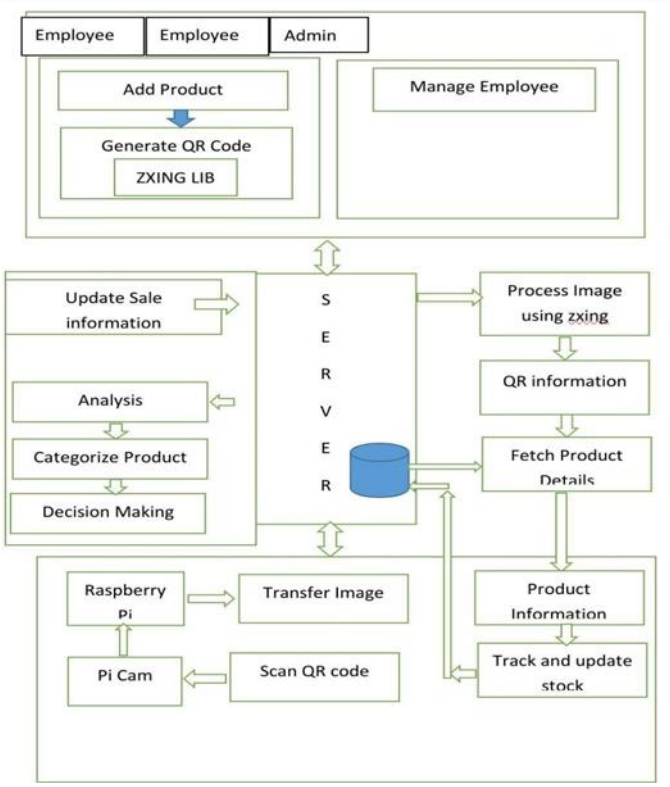
[3] Anas M. Atieh, Hazem Kaylani, and YousefAl-Abdallat, "Performance improvement of inventory management system processes by an automated warehouse management system",2015

This paper focuses on the impact of a warehouse management system on supply chain performance that provides less resources effort, more efficient, and reliable inventory management system. Microsoft Visual Studio Express systems have become less efficient and unsuitable for today's market requirements, that is why new technologies have started to emerge to be used for such applications. the software used. The software created here upgraded the capabilities of the warehouse management system.

[4] Wala Hamdy, Noha Mostafa, and HeshamElawady, "Towards a Smart Warehouse Management System",2018

The main goal of the project is to achieve harmony of coordination and linkage between the suppliers, customers and organisation to improve the overall performance and reduce the cost. Warehouse Management Systems have been developed for monitoring, tracking and controlling the various warehouse operations, but with the increasing dynamicity of the market,traditional.

III. Methodology And Modules



Add Product Details and Generate QR code

- Admin login to the portal by using user ID and password.
- Admin adds the item details, and the details are stored in the database.
- Admin uploads the product image too.
- Server generates the QR code of the product that contains the product id, product name.

Maintain Stock

- Employee can login using the raspberry pi.
- Server validates the login credentials.
- Employee can scan the product QR code that arrives in the warehouse.
- The captured image is sent to the server to get the product details.
- Server processes the QR code and fetch the product details from the database.
- The details are sent to the raspberry pi.
- Employee can see the shelf number where the same category product is already there.
- If not then he/she can add the shelf number assigned and updates to the server.
- The new quantity is updated in the database.

Search Product

- Employee can search any product using the raspberry pi by entering the product name or id.
- Server send the product details if found.

Sales and Recommendation

- Storekeeper can login into the portal by using the login credential.
- Can make bill for the customers.
- Updates the sale report to the server.
- The quantity of the sold items is updated in the database.
- Using machine learning we categorize the products based on the sales and quantity.

A. Data Preprocessing

1) Importing the dataset: In our study we have used the dataset collected from a grocery store to check the future sales or demand of an item outlet. It includes the following attributes: Item_identifier, Item_weight, Item_type, Item_MRP, item_desc, Item_Outlet_sales Dataset is imported by saving the dataset file as CSV file.

2) As a part of data cleaning, some columns are needed to be removed which do not contribute to attaining the results of the algorithm. Here item_desc is dropped.

3) Handling missing values: Missing data is something that needs to be manipulated so that there remains no discrepancy in the data to be fed into the model. Here there were some missing values in Item_weight column. In case of in case of Item_weight the missing spaces are filled with mean of all the other entries in the column of same category.

4) Feature scaling: Feature scaling is a method in which we scale the data into an accurate and scalable size for the purpose of increasing accuracy and reducing error. It basically prevents the large variance of data points to be used in the algorithm and allows us to achieve better results. StandardScaler is a class imported from sklearn library. Here, standardization method has been used. We have standardized 'Item_weight' and 'Item_mrp'.

5) Extracting Independent and Dependent variables: Dependent variables are the targets or the output variables which needs to be finally evaluated and then compared against each other. Independent variables are the features or the input variables which can't be changed by any means and accordingly the targets are predicted. Independent variables include: 'Item_weight', 'Item_type', 'Item_mrp', 'Outlet_type'.Dependent variable include: 'Item_Outlet_sales'

6) Splitting the dataset into training and test dataset: To avoid overfitting, two separate datasets are not imported for train and test. So, splitting is done in a single dataset. The training dataset are the data we need to train the model on. Test datasets are those ones which can be used to predict the outcome of a test.

IV. SYSTEM REQUIREMENTS

A. Hardware requirements

System: Intel i3 2.1GHZ

Memory: 4GB.
Hard Disk: 40GB

Raspberry Pi 3B+

Pi Camera

Raspberry Pi Display

B. Software Requirements

OperatingSystem: Windows10.

Language: JAVA, HTML, CSS ,Python

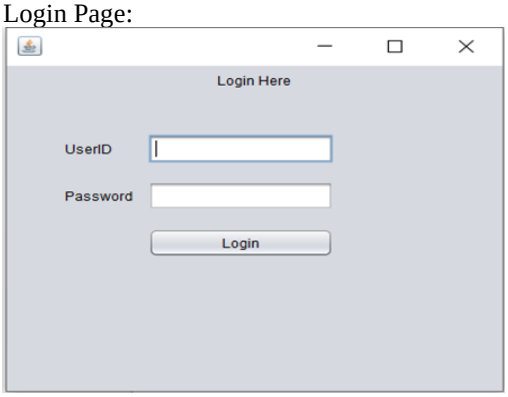
Tool: NetBeans, navicat lite for mysql, Jypyternotebook

Database: MySQL

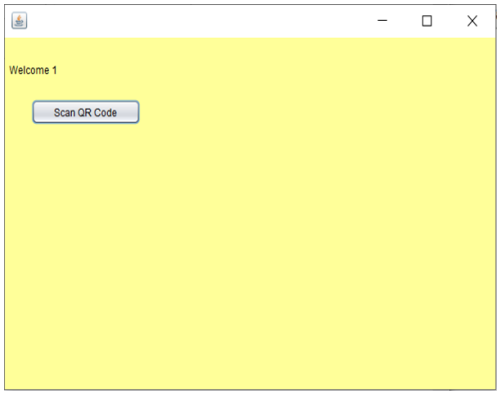
LocalServer: Apache Tomcat

V. RESULTS

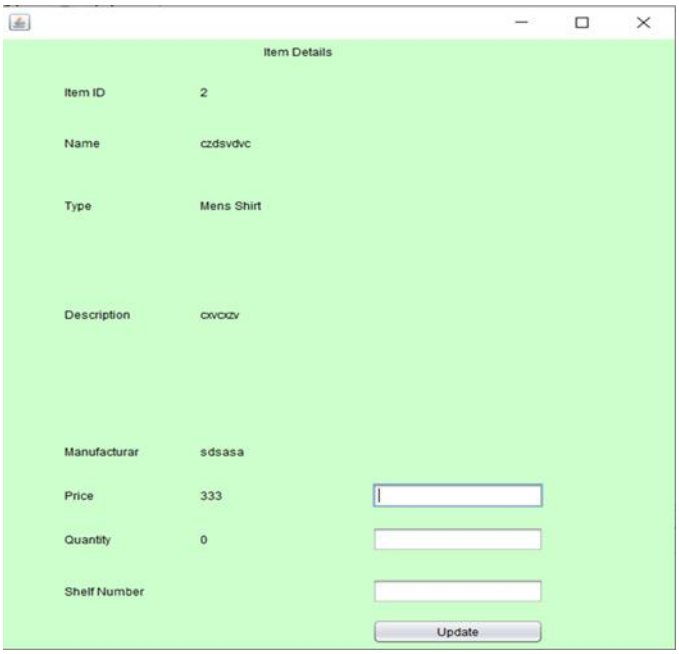
Login Page:



Welcome page with QR code scan button:



Item Dataset page:



Raspberry Pi Setup:

VI. Conclusion

Thus, a complete stock management system was created which would help the admin/shopkeeper/workers of the center to maintain their stocks using the QR code. It will reduce the worker's efforts to manually maintain the track of each item and their headache of maintaining the register since everything would be stored in the database.

It will also make the workers give accurate item prices to the customers and will reduce the process time in which the worker goes to the owner to ask information related to the item and save the time to calculate the item price, since the current product price and quantity will be automatically fetched from the server. The recommendation system helps the owner to take proper decisions while maintaining the stock in the warehouse.

Acknowledgment

We would like to take this opportunity to express our gratitude to our Guide, Prof. Sheelavathy K V, Associate Professor, REVA University, for continuously supporting and guiding us in our every endeavor as well for taking a keen and active interest in the progress of every phase of our Project.

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[1] Samir Yerpude and Dr. Tarun Kumar Singhal, "Smart Warehouse with Internet of Things supported Inventory Management System", May 24th,2018

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