Martbotica - Supermarket of Future

Mayank H. Prajapati1, Sumit P. Kabiria2, Mayank R. Prajapati3, Vardan S. Patel4, Suchita Sunil Borkar5

1,2,3,4 Student of B.E Electronics and Communication Engineering in Laxmi Institute of Technology, Sarigam
5 Assistant Professor, Department of Electronics and Communication Engineering in Laxmi Institute of Technology, Sarigam

mnkprajapati143@gmail.com| sumit.kabiria@gmail.com| mykprajapati84@gmail.com| vardanpatel39@gmail.com| suchita.lit@laxmi.edu.in

Abstract- Automation is the current trend which will bring about visible change in various fields of science & technology. This “Martbotica” proposes the design with no public interference, where customer will select and list out the products from the display, and then it will be available to the customer within few minutes. Collection of product from a big storage can be done using Automation. In the existing system customers has to stand in long queue at the payment counter which is time consuming. Whereas the labour required maintaining the supermarket are also high. The implementation of this system improves the efficiency & area occupied by the existing supermarket. This type of automated system can simultaneously deliver large number of products from the storage location to the desired place without human effort with minimal delay.

Keywords- PLC, Pneumatic Cylinder, Motor, Conveyor, Supermarket, Automation, Warehouse.

I. INTRODUCTION

This system proposes a new design of supermarket using automatic warehouse system and robotics. The design of existing supermarket is such that the customers have to find the products by themselves which is time consuming. They have to stand in long queue for payments of the bill. Surveillance camera for monitoring the ongoing activities as well as central AC consumes energy. More numbers of staffs are required for the maintenance. After considering these major issues in the existing supermarket, this system intends to propose a new and efficient design for the supermarket, which will overcome the above problems. The products ordered by the customers will be collected by the robots through PLC and SCADA. After collecting the products, with the help of conveyor belts it will reach at packaging counter. The products will be packed automatically as per the desired list and afterwards customers can collect the products from the receiving counter.

II. LITERATURE SURVEY

This section includes the literature survey for this system.

System and method for piece-picking or put-away with a mobile manipulation robot

In the year January 2015, Thomas Galluzzo Jean Sebastien Valois Vladimir Altman proposed a system for piece-picking. The system enables robotic picking using a high degree-of-freedom manipulator arm on a mobile base that can autonomously navigate and position itself. The articulated manipulator arm having an end effector (i.e. gripper), one piece containment area, sensors, a remote communication interface, a robot memory configured to store robot specific information, and one or more robot processors coupled to the sensors, the robot memory, the mobile base, and the at least one articulated manipulation arm. The system further comprises a conveyance device (i.e. conveyor) configured to accept pieces from the at least one mobile manipulation robot, which transfers the accepted pieces from a transfer area to a receiving area, wherein the receiving area is a packing area, a shipping area, a holding area, or any combination. The mobile manipulation robot includes batteries or a charging port for connection to a charging station. Such charging can be achieved through wired connection to warehouse power, or automatically via a charging port or station.

The advantage of this system is that it reduces the time, which was been spent travelling from one item storage location to another.

Apparatus and method for automated warehousing

In the year 2008, Gregory Scott Duncan, Allen Root Ravi S. Sanka, Daniel Tsu-Fang Wang had introduced an system for automated warehousing. Method for operating the same are disclosed for handling products with minimal handling and human intervention. There are three methods described here namely the pick-to-light, the A-frame and the horizontal channel picking/placing methods. In light-to-light method, a light illuminates at the location where the desired product is placed in the warehouse and an employee must then manually remove or pick a desired amount of the product from that location.
In accordance with the A-frame method, a product is stored in particular ones of vertical channels associated with an order processing device. The conveyor, with the belt section, passes underneath the vertical channels and the desired units of products are dropped onto the belt. In the horizontal channel placing/picking method, a product is stored in horizontal channels with a product being assigned to a pre-determined number of such channels. A belt section, or alternatively, a bin, on a conveyer is assigned to a specific customer order. The conveyer, with the belt section, passes under the horizontal channels. Those channels contains a product requested by the customer order dispense the proper number of units of the product onto the belt section. The belt section, after receiving the product, passes under the next channel and the process continues.

The disadvantage in all the three methods is that as the channels gets depleted of the products, human intervention is needed for manually replenishing with additional cases of the product.

**Supermarket shopping management system**

In the year 2016, Sigal Carmeli introduced a supermarket shopping management system. It includes ordering module, marking device, communication module, processing center, network of conveyors, pick-up module. The user marks (via barcode) the desired products through the marking device generally an software application on a smartphone. Now through the communication module the desired products are commanded to the pick-up module via processing center.

The advantage of the above system is that it reduces time for standing in line.

The disadvantage of the system is that when a junction conveyer has to enable entrance of two products from different linear conveyors, one of the linear conveyors must stop moving until the other linear conveyer ends its transfer.

**III. PROCESS FLOW**

The following is the process flow of the system.

**IV. BLOCK DIAGRAM**

The following is the block diagram of the system.
The following is the design of the supermarket.

The figure-1 shows the design layout of the invention. This design is divided into two parts, one is rest area and other is automatic warehouse. Firstly the customer will enter from the gate(1) in the supermarket. For the customers satisfaction different demo products are displayed(3) which all are available in the supermarket. Customers will give their shopping list at the ordering counter(5) or even they can select the products from the display. There are few ordering counters(5) and receiving counters(7). After giving the shopping list the customer can sit(4) and wait till the listed products are available at the receiving counter. The worker at the ordering counter will assign that shopping list to the robot(8). Robot will collect all the products according to the list from the corresponding racks(9) and will place it on the conveyor belt(10) one by one. Further the products collected from each racks will be guided to the packaging counter by the master conveyor belt(11). At the packaging counter, the products will be automatically packed according to the master conveyor belt(11). The worker at the packaging counter will assign that packing list to the robot(8). Now the customer can collect their products from the receiving counter(7) and pay the bill. The customers can exit through the gate(2). This project shows the working model of the dotted portion(13).

VI. WORKING THROUGH SCADA

The following steps describe the working of this system through graphics.

Step 1: Robot at its home position and assigning the product to the PLC.

Step 2: Robot picking the product-1 (i.e. Chocolate).

Step 3: Delivering the product-1 to the conveyer belt.

Step 4: Assigning the robot through PLC to pick the product-2 (i.e. Milk).
VII. Conclusion

Buying goods in supermarkets presently can be a very slow process. A consumer takes a cart, passes through the shelves and fills the cart with the products he wants to buy. Then he goes for checkout, waits in line, and when his turn comes, the cashier scans the barcode of the products. The only improvement in decades is scanning the barcode of the products instead of adding their prices individually. Therefore, this system proposes a new design of supermarket with advanced technology. This design of the supermarket is such that the customer just has to order their desired products and the products will be automatically available to the customer, without using much human intervention. The system uses PLC for the controlling and commanding the robot. An input to the PLC is given through SCADA. According to the inputs, PLC commands the motor via relay to reach to the desired location where the product is kept. The product is collected through the pneumatic cylinders and is placed on the conveyor belt. Further through the conveyor belts the product is ready to be received by the customer. This design of supermarket will eliminate standing in queue for the payment and use of trolley. It contains less human intervention and geographical area. Provides easy shopping experience.

Future Scope

This project work can be extended by adding features such as collecting multiple products at a time, home delivery and giving discount & promotional offers to the customers.

References