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RFID Based Supermarket Queue Prevention and Automation System for Physically Challenged People

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Abstract: **Shopping at big malls is becoming daily activity in metro cities. We can see huge rush at these malls on holidays and weekends. People purchase different products and put them in the cart. After completion of purchases, one needs to go to billing counter for payments. At billing counter the cashier prepare the bill using bar code reader which is very time consuming process and results in long queue at billing counter. This paper describes how to build an automated and time saving system for the world of retail which will make shopping experience impetuous, customer friendly and secure. In this paper, smart cart is proposed that will be capable of generating a bill from the cart itself. The main objective of proposed system is to provide a tlow-cost, easily scalable, and rugged system for assisting shopping in person**

Keywords: **PIC Microcontroller, RFID Reader, RFID tag.**

I. INTRODUCTION

During the last decade the commercial use of RFID has been growing rapidly all over the world. Everywhere retailers are increasingly embedding RFID technology into their supermarket products in order to improve the customers' shopping experience, customer support and develop new services for customers. RFID is a technology that uses radio waves to track, capture, identify and transfer data efficiently and without human intervention. RFID-based system gathers data about a certain object without touching it or seeing it stag and forwards the information to a host computer. RFID-Readers are able to establish a channel of communication, read the tags and trace the movement of these objects within the coverage area.

RFID is a promising technology which can improve operational efficiency specially a considerable amount of reduction in transaction costs. Tag detection does not require human intervention therefore reduces employment costs and eliminates human errors during data collection. Item-level deployment of RFID technology would also allow for quick checkout aisles that scan all products at once and thus eliminate queues, which are consistently reported as one of the most negative aspects of supermarket shopping.

II. LITERATURE SURVEY

Currently most of the supermarkets use a barcode based system whereby an item is assigned a serial number printed on the barcode label attached to an item and the item related information is stored in the database of the back-end system. To perform inventory control, someone has to scan the barcode label of each item and compare them with existing inventory list. This is a lengthy and error prone process; as a result it's done less frequently and hence often is not up-to date. The most important factor is that in barcode scanning the product should be in the Line of Sight (LOS) of the reader in order to get the barcode imprinted on the product scanned.

In 2009, the University of Arkansas Information Technology Research Institute completed a study to determine the business value of RFID item-level tagging for day-to-day operations at a major luxury retailer. The results demonstrated that overall inventory accuracy improved by more than 27 percent, under stocks decreased by 21 percent, and overstocks decreased by 6 percent. The study also compared how long it took to count items using RFID vs. a barcode reader. With RFID, scanning 10,000 items took two hours; scanning with a barcode reader took 53 hours [1]

Nearly 15 billion pairs of shoes and 10 billion fashion apparel items ship from manufacturers every year. The costs for conducting manual inventory of these items, managing out-of-stocks, and preventing theft continue to rise. Apparel retailers are rapidly adopting item-level tracking to enable accurate visibility of each garment. Perpetual inventories are running at 60-70 percent in real-time, making it difficult to make proactive business decisions for creating in-store sales lift [2]

An innovative product with societal acceptance is the one that aids the comfort, convenience and efficiency in everyday life. In this paper, a novel product has been developed to assist a person in everyday shopping in terms of reduced time spent while purchasing a product at the best price available. The main objective of this paper is to provide a technology oriented, low-cost easily scalable and rugged system for assisting shopping in person [3].

Public awareness of RFID was heightened in recent years when the U.S. Department of Defense (DoD) and retail giant Wal-Mart required their suppliers to use RFID technology. In January of 2005 Wal-Mart's CIO stated that using RFID has resulted in a 26 percent reduction in out of stocks in the stores with RFID capabilities, and out of stock items that are replenished three times faster than those items not RFID tagged [4].

Bill McBeath in April 2013 said, to survive in 2013 and beyond, retailers need to make it easy for consumers to buy anywhere, receive anywhere, and return anywhere. The key to this cross-channel order promising is the ability, in real-time, to locate and allocate available inventory from any location, whether in the store, in DCs, in transit, or on order from the manufacturer. This requires having a very accurate, real-time, item-level picture of inventory at all these sources[5].

III. SOLUTION PROPOSED

This project uses more enhanced approach of **"RFID based automatic billing system"**, RFID provides capability to uniquely identify an object within a supermarket area, while agents are able to establish a channel of communication which can be used to facilitate communications between a RFID device and supermarket back-end system. The designed smart cart uses RFID technology for shopping and billing, thus it is customer friendly. And now with this automated system retailers will recognize the value of tagging individual pieces of merchandise that will overcome the problem of the product being in the Line of Sight (LOS) of the reader.

IV. SYSTEM ARCHITECTURE

The architecture of the system proposed is shown in figure 1.The components included in the system architecture are as follows:

1. Microcontroller
2. RFID Reader
3. LCD
4. EEPROM
5. MAX232
6. Motor for Cart Unlock Mechanism

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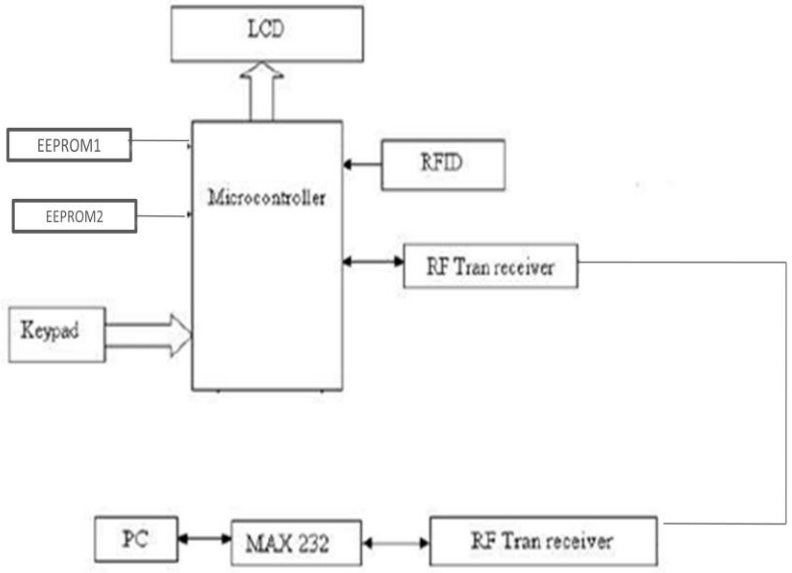

Fig.1 Block Diagram of Smart Cart

The proposed shopping mobile cart is equipped with a RFID reader, a RFID antenna and an embedded computer system. A LCD touch screen is mounted at the front of the cart and acts as a user interface console that facilitates and monitors customer operations. When a product is dropped into the cart, the cart's RFID reader will be able to identify the profile of each product via its RFID and display product information (name and cost of the product, product specifications and features, consumer reviews) on a LCD touch screen The RFID signal is limited to within the shopping cart. It will carry data on items in the cart with their prices, as well as the total price. The store will also be able to play advertisements on the LCD based on the physical location of the customer in the supermarket. The interfacing of the microcontroller with other hardware components is depicted in figure 2

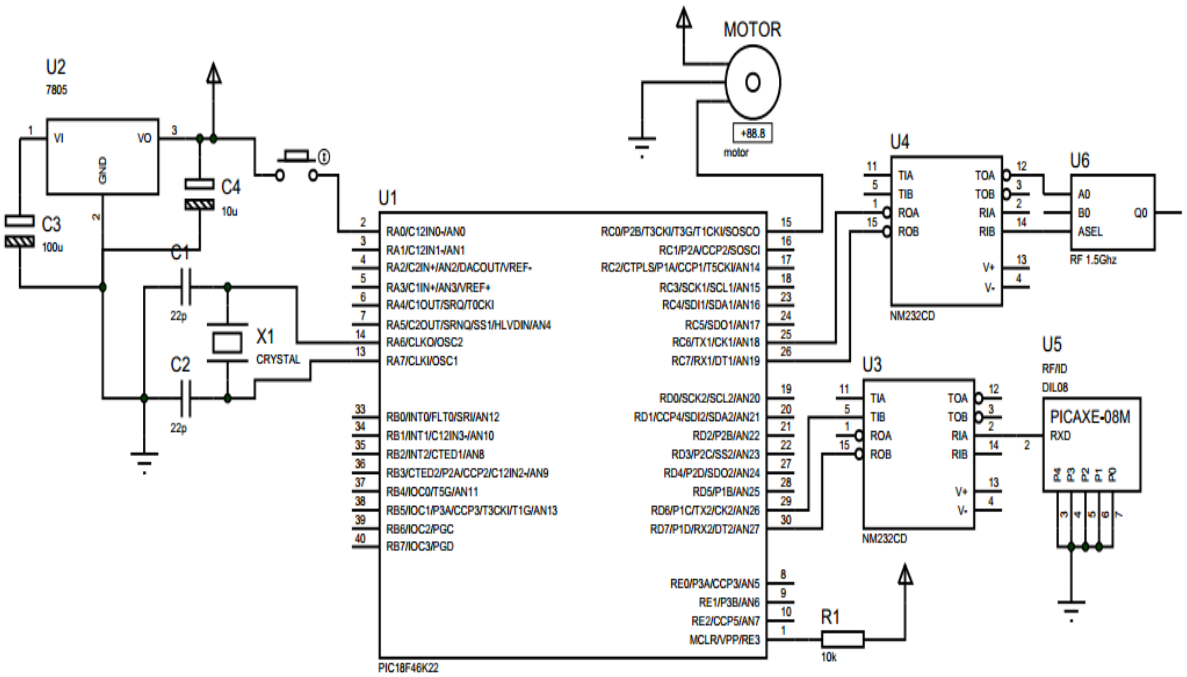

Fig. 2 Interfacing of Microcontroller

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V. IMPLEMENTATION

The smart cart can be implemented in the following way:

- **Server module:** The primary aim of our project is to implement RFID based automatic billing system with an effective GUI for supervisor at the server end which is shown in fig3 To achieve this need, we have created an interactive application using Windows forms, which is one of the powerful tools in Microsoft .NET framework

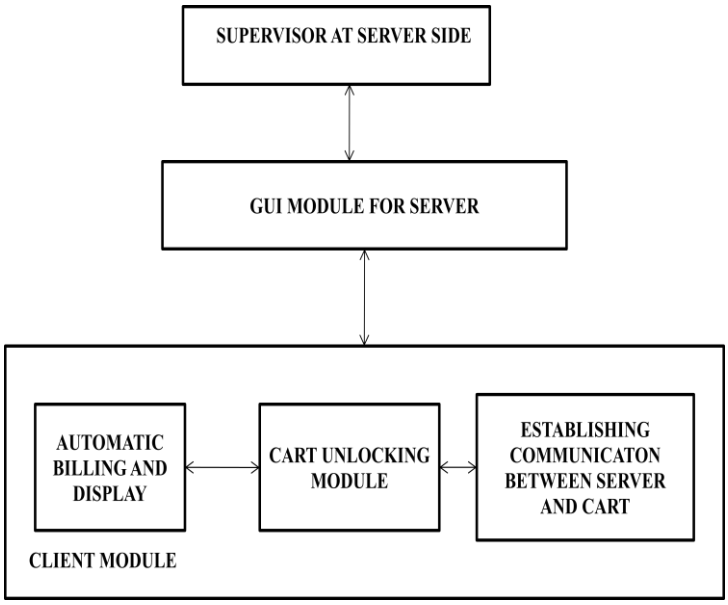

Fig.3 GUI for server module

- **RFID module:** Communication between the cart and the server takes place through RFID module which consists of RFID Tran receiver when all the purchases are finished by the customer and complete button is pressed the total amount of the purchased RFID tagged products which are stored inside the microcontroller is automatically transferred to the server. By connecting the cart to the server using MAX 232.

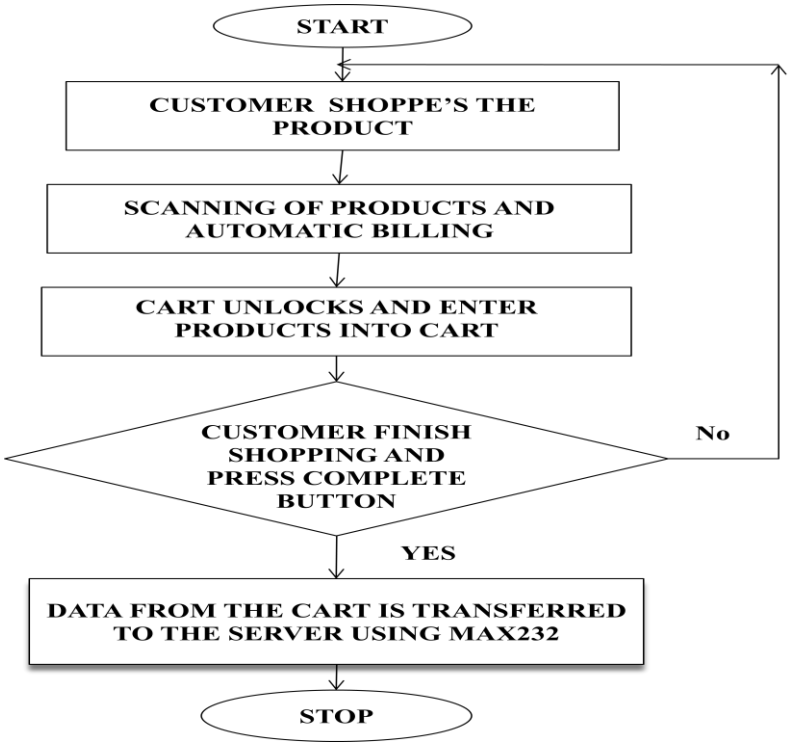

Fig. 4 Flow Chart for item scanning and transferring data to the server

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- **Automatic billing and display module:** When the customer starts shopping he adds the product to the cart or removes the product from the cart the product are scanned by reader and billing is done automatically and the information related to the product and the total price is displayed on the LCD simultaneously as showed in fig 5

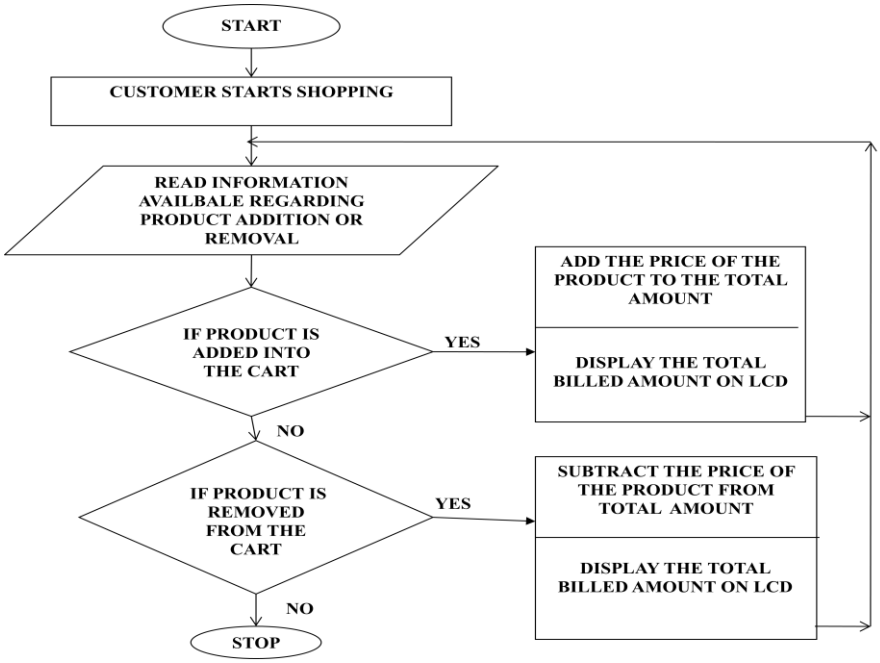

Fig 5 Flow chart for automatic billing and display

- **Cart unlocking mechanism:**

Initially the cart will be in lock status As the customer start shopping and selects registered RFID tagged products item selected gets scanned and signal goes to the microcontroller for automatic billing and cart unlocking. The signal from microcontroller goes through motor driver to DC generated motor and motor operates and rotate in anticlockwise direction and finally cart is unlocked. As shown in fig 6

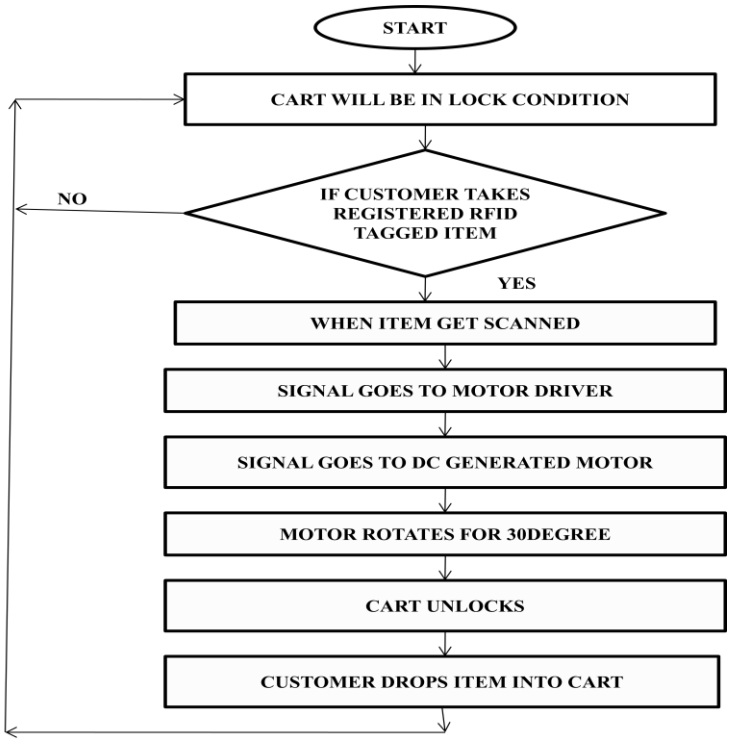

Fig 6 Flow chart for cart unlocking mechanism

VI. CONCLUSION

The intended objectives were successfully achieved in the prototype model developed. The developed product is easy to use, low-cost and does not need any special training. This project reviews and exploits the existing developments and radio frequency identification technologies which are used for product identification, billing, etc. Easy shopping in the malls to save time, energy and money of the consumers.

VII. FUTURE SCOPE

Smart cart can be interfaced with wireless technologies to make it completely portable in the near future. A low cost RFID scanner can be manufactured and used which can scan multiple tags (products) simultaneously for faster processing and lesser resources. Automatic scanning & availability of products can be introduced. Pay scheduling feature will be the latest trend in upcoming years due to the boost in the e-commerce industry.

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