

RFID Aided Automatic Billing Trolley System

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Abstract: *Shopping is one of the primary and important aspect of day-to-day life. Each and every item which we use are been purchased. When coming to metro cities the time is an important aspect to be considered. As purchasing and shopping goods at super markets and malls is becoming daily activity. We can see big rush during holidays, weekends at billing counters. Even though we shop the required items quickly, more time is consumed at billing counters during billing. Especially the crowd increases during the festive seasons because of the discounts offered by the producers. The present criteria during shopping is customer selects the required items and put them in trolley, after picking all the items one has to go to the billing counter for payment process. At billing counter the cashier will read the bar code which is on the product using the bar code reader and prepares the bill, which involves too much time and results in long queue at billing counters. To reduce the inconvenience, this project aims to provide an automatic billing trolley using RFID technology which reduces the queue in malls and super market.*

Keywords: *RFID technology; Real time; shopping mall; trolley; Renesas Microcontroller*

I. INTRODUCTION

Innovations in communication and information technologies has caused a revolution in values, knowledge and perceptions in practically all areas of human understanding. The current scenario of shopping is classified into two categories: (1) shopping in-person and (2) shopping in-absentia. Comparing both shopping in-person is more advantageous, because the customer will have an accurate check of quality and quantity of the product as the customer is physically present and even selecting the products based on various parameters including need, convenience, brands, discount and offers etc. But whereas in shopping in-absentia the customer has to blindly believe the producers as he is physically absent. Our aim is to develop an intelligent shopping cart which can overcome the disadvantages of the present problems. Here we are using the emerging technologies, such as Radio Frequency Identification (RFID) and wireless networks which makes shopping process faster, easier, transparent and efficient. The proposed system intends to assist shopping in-person that minimizes the time of shopping by the customer and it also beneficial to the store management because the real-time updates on the availability of the stock can be updated timely. The intelligent shopping cart is equipped with Radio

Frequency Identification (RFID) for each product identification and a consistent Wi-Fi connection with the shop's server. Besides this, it also has a LCD display that informs the customers about the price, discount/offer, quantity, quality and total bill etc. As soon as the product is dropped or removed from the cart, the RFID reader reads the RFID tag, identifies the product and updates the bill. When the customer is done with the shopping, he has to just press the "End Shopping" button and the details are sent to the shop's server and the customer just needs to pay the amount. The proposed cart is easy to use and does not need any special training for its usage. The cart's inbuilt automatic billing system reduces the time consumption during billing process, and repetitive scanning and checking of products.



Fig 1. Long queue in the shopping mall and super market.

II. LITERATURE SURVEY

Due to the inventions and advancements in the fields of communication and information technologies, caused a revolution in all areas of human understanding, deeply carving the so called "Age of Information and Knowledge". Human being have invented and adopted the technology for their needs and comfort since their existence. Main purpose of innovations in technology, irrespective of domain is to make the daily activities easier, faster and more accurately.

According to a survey conducted by US Bureau of Labour, on an average, human beings spend 1.4 hours every day on shopping. A survey done by Visa in 2005, points out that an amazing 70% customers will walk out of a queue if the line is too long, and 10% are "seriously annoyed" the moment they step in a queue. Further, according to a study conducted by CISCO Internet

Business Solution Group, the top four reasons for shoppers to use technology are to (i) Find best price (63%), (ii) Save time (47%), (iii) Find best assortment (26%) and (iv) find best quality (25%).

A. PROBLEM DEFINITION (EXISTING SYSTEM)

Shopping is one of the primary and important aspect of day-to-day life. When coming to metro cities as purchasing and shopping goods at super markets and malls is becoming daily activity. We can see big rush during holidays, weekends at billing counters. Even though we shop the required items quickly, more time is consumed at billing counters during billing, where the cashier needs to prepare the bill using bar code reader which is time consuming process and results in long queue.

III. PROPOSED METHODOLOGY

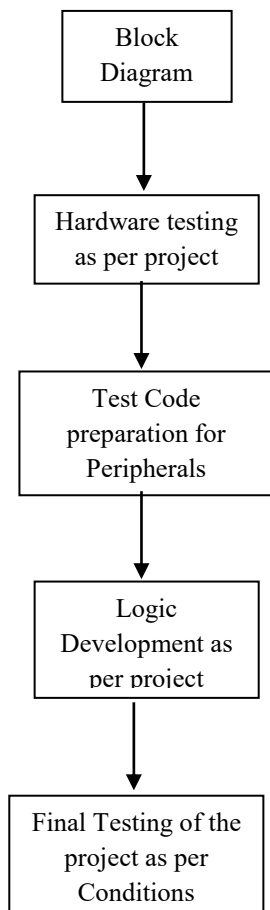


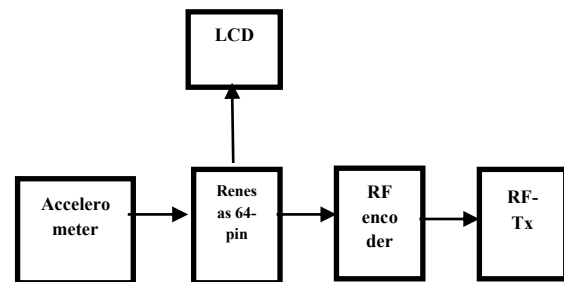
Fig 2. Design and development flow

In the proposed methodology, the automatic billing system for the customers during shopping is mainly based on the RFID technology aided with the gesture based control of the trolley. Each and every item in the shopping mall or super market is provided with the RFID tag instead of barcodes. The entire system can be divided into a Transmitter part and a Receiver part. The transmitter part includes the Accelerometer circuit. The

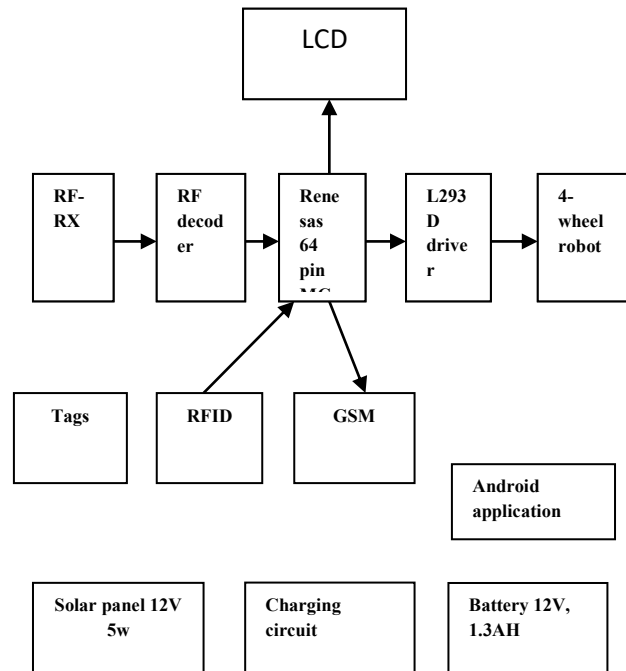
receiver side consists of the trolley. The trolley setup includes the RFID reader, a GSM module, LED's, buttons to indicate the start and end of the shopping, a LCD panel to display the product information, a Motor driver circuit in order to control the movement of the trolley and finally a solar panel and a power supply to the trolley(battery).

IV. BLOCK DIAGRAM

A. Transmitter Part



B. Receiver Part



MICRO-CONTROLLER: A Renesas micro-controller is used for this application. It belongs to RL78 family. The name of the IC is R5F100LE. It is a 64-bit, 16 pin IC. It consists of 15 programmable I/O lines and three UARTs. It can perform high speed operations of up to 32MHz main clock (oscillator used) when supplied with 2.7 to 5.5V. This micro-controller is preferred because of its high performance, broad scalability, high quality and safety and cost reduction.

RFID TAGS: These tags can be classified into "Active tags" and "Passive tags". Active tags are those that consists of a microcontroller chip and a built in power supply. Passive tags are those in which a power

supply is absent. These tags consist of a microchip to store the information and a coil type arrangement that acts as an antenna for radiating the stored information. The primary purpose of the tags is for the unique identification of the products. When tag is brought into the coverage range of the reader, the reader emits RF signals in order to power up the passive tag and collect the information present in it.

RFID READER: For this application EM-18 is used. It operates at 5V DC and 50mA. It operates at 125KHz frequency which gives us a coverage range of about 3 to 4 centimeters. The purpose of the RFID reader is to collect the data stored in the RFID tag, process the collected data and display the processed information on the LCD.

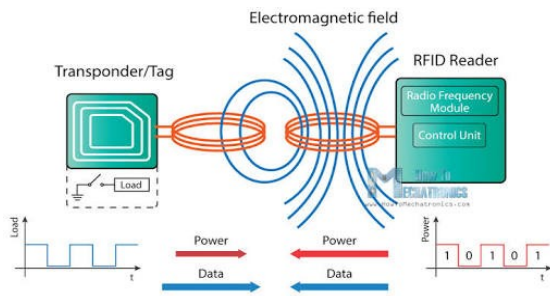


Fig 3. RFID communication

LCD: It is a Liquid Crystal Display. It consists of 4 rows and 20 columns. The LCD is connected to the 7th port of the micro-controller. The main purpose of the LCD is to display information to the customers such as a welcome note, details about the product, etc...,



Fig 4. 16*4 LCD display

DC MOTOR: A DC motor is used here to aid for the movement of the trolley. The frequency of rotation is around 60rpm for our application and it operates at 12V supply. The capacity of the motor can be varied depending on the weight that a trolley can handle.

MOTOR DRIVER CIRCUIT: We use a L293D motor driver circuit in order to control the rotation of the motors and so the movement of the trolley. It can control small and big motors as well. It is a sixteen pin IC and it is capable of controlling two DC motors simultaneously. It works on the H-bridge concept.

ACCELEROMETER: An accelerometer circuit is used at the transmitter side in order to decide the acceleration and direction of the trolley. It may be a

remote or a wrist band and even it can be connected through wires to the trolley or it can be wireless. The accelerometer detects the movement of the wearer's hand through its X, Y and Z axis and accordingly sends the signals to the motor driver circuit to decide the direction of the trolley's movement.



Fig 5. Accelerometer IC

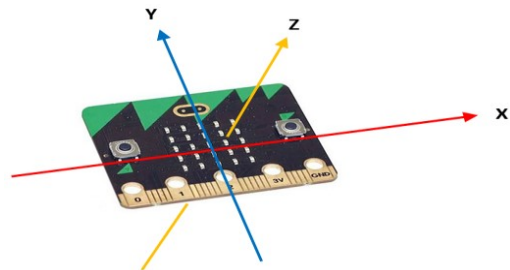


Fig 6. Accelerometer axis

GSM Module: GSM stands for "Global System for Mobile Communication". It is a standard that is globally accepted for cellular communication. It is a TDMA based system. It operates at either the 900MHz or 1800MHz frequency band. In this project the main purpose of the GSM module is to transmit the billing information to the customer's android device with the aid of an android application.

Power Supply: The power supply to the trolley will be a 12V, 1.3Ah battery along with the charging circuit. In addition, we include a 12V,5W solar panel for additional power and also to reduce the repeated charging process of the battery inside the trolley. **Start and End Buttons:** Here two buttons will be incorporated to indicate the start and end of the shopping.

V. WORKING OF THE PROPOSED SYSTEM

Customer authentication is one of the important steps in the process. So the customer is first provided with a smart card that is enabled by RFID. In order to use a trolley a customer should first assign it to him by scanning the smart card using the RFID reader present in the trolley. The authentication may also involve a verification through an OTP (One Time Password) by the use of an android application and GSM module. When the customer is done with the authentication process, he is

now allowed to use the trolley by pressing the “START” button to start shopping.

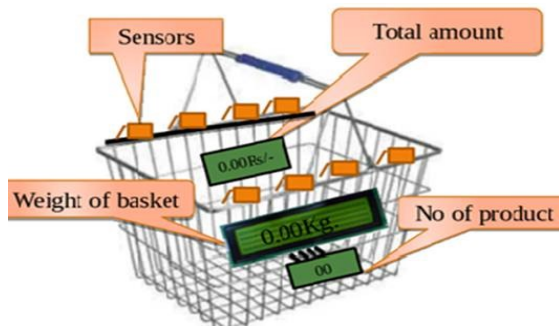


Fig 7. Components embedded on the trolley.



Fig 8. RFID reader working inside the trolley.

Every item inside the shopping mall or the supermarket contains the RFID tag. Whenever the customer picks an item and drops it into the trolley, the item will be detected by the RFID reader and the reader reads the information present inside the tag and displays it on the LCD panel. (Note: The operating frequency of the RFID reader is 125KHz and it gives a coverage range of 3 to 4cm so only the items dropped inside the trolley will be detected). The tag contains the cost and all the details of the product. The number of items that a trolley can carry depends on the capacity of the trolley and also the weight constraints. The movement of the trolley is based on the gestures given by the customer through the accelerometer. Soon after every item is dropped into the trolley, its respective price and details are displayed on the LCD. Whenever a customer removes an item from his trolley, the bill of the respective item will be subtracted from the list automatically. After all the required items are placed into the trolley, the customer should press the “END” button in order to finalize the bill.

After the bill gets finalized, it is sent to the customer’s android device using GSM module for future verification purposes. The customer can now pay the bill at the billing counter using the data(final bill) shown on the LCD of the trolley or as shown in his android device.

VI. ADVANTAGES

- Implementation of RFID tag on products intend helpful in prevention of spare time, And moreover detailed information of products can be easily identified with the ease of time.
- This will be the latest technology to be used for theft detection in shopping Malls in contradiction to the stealing of product and fraudulent habitats of customer. Since we are using RFID as a reader, it can scan multiple tags in milliseconds and work automatically.
- An RFID reader can scan a tag as long as it is within frequency range.it doesn’t have a line of sight limitations .alternative ID solution such as barcoding, requires the reader to be close to the barcode before it can “see” it to scan to it.In some cases through obstacles between the tag and the reader, the RFID system can automatically pick up tag IDs from the distance.



Fig 9. The Final trolley setup.

VII. DISADVANTAGES

Although the RFID technology has been around since 1970’s, its initial high costs restricted usage to large businesses, many of whom developed proprietary systems. Although costs are falling, RFID systems are typically more expensive to set up and use than alternative systems such as optical scanning .However ,RFID systems brings their own cost befits ,such as reduced labour costs and improved efficiency.

VIII. APPLICATIONS

Improves the circulation operations. While barcode requires line of sight. Although real-time details of product information can be visualized such as EXPIRY DATE and present offers on current products, and even the most sold out products can be termed and pointed while choosing the products.

IX. RESULT

The above proposed model reduces man-power and improves the quality of shopping in malls and super markets.

X. FUTURE SCOPE

RFID is increasing in popularity among shopping markets, libraries, as the earliest adopters of the technology have shown that, it make good economic sense, both for small scale and large sale industries. These system provides you services like easier and quicker operation in terms of time management.

This technology helps to save the valuable staff time, which may otherwise be spent on scanning barcodes while buying the products. Thus it plays very important role in upcoming shopping criteria.

XI. CONCLUSION

The project is designed using structured modelling and is able to provide the desired results. It can be successfully implemented as a Real-Time system with certain modifications.

The merging of renewable energy mini-grids with regional or national power grids calls for standardized best practices and technologies to ensure safety, efficiency, reliability and best value for mini-grid operators, utilities and their customers.

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