ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 3, March 2017

Smart Trolley with Advanced Billing System

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ABSTRACT: The paper introduces a smart trolley which is of great use for shopping at the supermarkets remedying the difficulties like waiting in large queues at the payment counter,dragging the trolley throughout the shopping time and calculating the total cost of the items taken, hence providing the quickest shopping experience.
Once the trolley is taken along for shopping, it follows the customer throughout the shopping period leaving a certain distance, turns left/right or even ceases along with the customer, signals him/her of any obstacle comes in its way and sums up the total cost price as soon as stuffs are dropped into it. At the end of shopping, the customer can swipe the shopping card in the built-in billing system of the trolley for payment which will be accounted at the main counter. Hence the paper lights up a new way of shopping for the fast world out there.

KEYWORDS:RFID, Smart shopping, SSC.

I.INTRODUCTION

One third of major shoppers buy groceries on a budget. They also worry about going over it. A study in Atlanta grocery stores shows that smart shopping carts – carts that display the total price in a shopping cart – increased both a budget shoppers' confidence and how much they purchased [1].
When shoppers know exactly what they spend, they are more likely to reduce on brand names, and even though they spent an average of almost 22% more, they left the store happier than others who did not receive this feedback.
But this real-time shopping feedback actually leads non-budget shoppers to be more frugal. On average, they spend 19% less, and purchase fewer national brands and more of the less-expensive store brands [3]. The smart shopping cart looks like a normal one except for an interactive screen and scanner mounted near the shopper. Once the shopper swipes his store card, his shopping history is available for all kinds of purposes, from presenting a suggested shopping list to alerting him to discounts or reminding him about perishables purchased a month ago.
Although interest in smart shopping carts is increasing, retailers and consumer groups have concerns about how real-time spending feedback will influence shopping behaviour. Real-time spending feedback stimulates budget shoppers to spend more. In contrast, this feedback leads high budget shoppers to spend less. Furthermore, smart shopping carts increase intentions for budget shoppers while keeping them stable for high budget shoppers. These findings underscore fundamental unexplored differences between budget and high budget shoppers. Moreover, they have key implications for both infra and online retailers as well as app developers.

II.SYSTEM MODEL AND ASSUMPTIONS

In this paper, we discuss an innovative concept of RFID Based Smart Shopping and Billing. The key idea here is to assist a person in everyday shopping in terms of reduced time spent while purchasing a product. The main goal is to provide a technology oriented, low-cost, easily scalable, and rugged system for aiding shopping in person. The developed system comprises of a Server unit (SU), a User Interface unit (UIU), an in-built Billing Unit (BU) andCentral unit (CU).SU will help in establishing and maintaining the connection of the shopping cart with the main server. UIU will provide the customer with user interface and the billing unit enablesthe user to pay the amount and leave the place without waiting at the counter in large queues.

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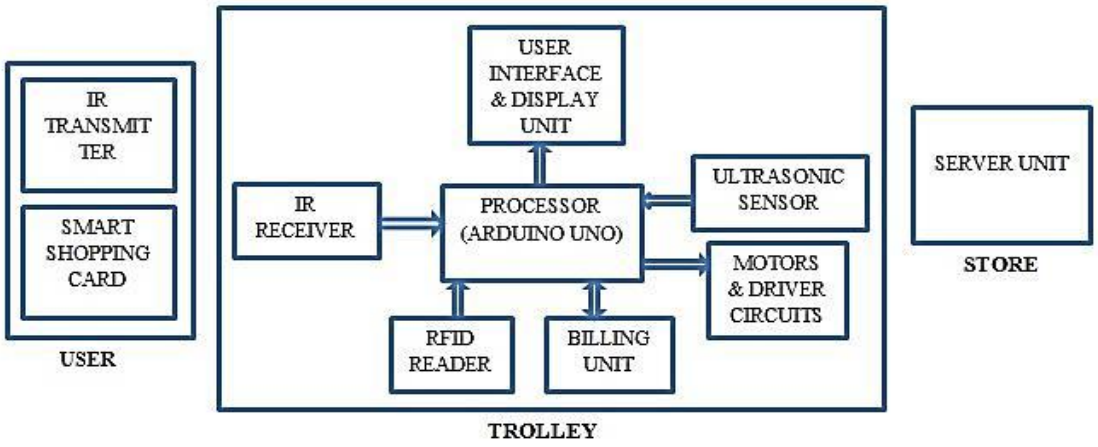

Fig.1. Block Diagram

These units are integrated into a smart enclosed system and are tested to satisfy the functionality. The smart shopping cart will help shorten the checkout lines thereby helping the customers at retail stores. The customers will be able to scan the items themselves and the LCD screen on the shopping cart will keep updating the total. This will turn out to be very beneficial for the retail stores as more people will enjoy the shopping experience and come more often to shop.
In the development and discussion of the intelligent shopping cart, we assume that the shopping arena is organized in aisles/bays, and each aisle is sufficiently wide enough for customers with shopping cart to move. We use the trolley following method instead of the traditional line following method, avoiding the requirement of IR transmitters placed at both ends of the aisle and on the cart to collect information on the entry/exit status of the cart and the bay identification. So there will be an IR transmitter that the customer can carry handy. Larger the distance between the aisles/bays, we will require stronger IR trans-receivers or we can use RF transceivers instead. Moreover the positioning of these IR trans- receivers on the shopping cart and on the aisles will be crucial to the proper functioning of shopping cart. Further, as IR technology works on line of sight, it is important to ensure that there is no obstruction in the entrance or exit of each aisle. To eradicate such a problem, we are using three IR receivers in right, left and center zones of the trolley such that even if the customer moves out of the range of one IR receiver zone, the other will catch the signal. In addition, we are using an ultrasonic sensor to keep a minimum distance between the customer and the trolley following and to alert the customer if any other obstacle comes in between.

Radio Frequency Identification (RFID) is becoming preferable technology as an alternative to barcode systems.The RFID data contain valuable information for marketing, such as shopping time and distance as well as the number of shelf visits. RFID systems provide an automatic identification method, relying on storing and remotely retrieving data using RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product for the purpose of identification using radio waves.

The point of attraction in the system is an in-built billing system where each user will be having a Smart Shopping Card (SSC) which again is an RFID based card and contains some amount of money that the user have already kept aside for shopping purposes. The display unit shows the balance amount the card holds as soon as the RFID reader identifies the user's card and the amount for which he/she have purchased will be deducted from the balance.
The UIU provides a facility of letting the server know that the shopping is done by the use of switches. All the product information is stored in a database at a central server with the location information as an attribute. RFID tags are used to uniquely identify products.

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III.PROGRAM FLOWCHART & DESCRIPTION

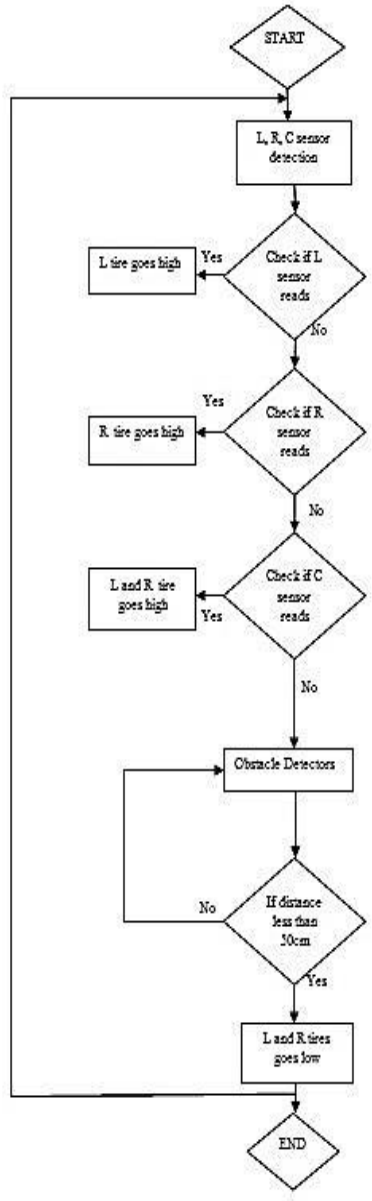

Fig. 2. Flow-chart of Motor Control

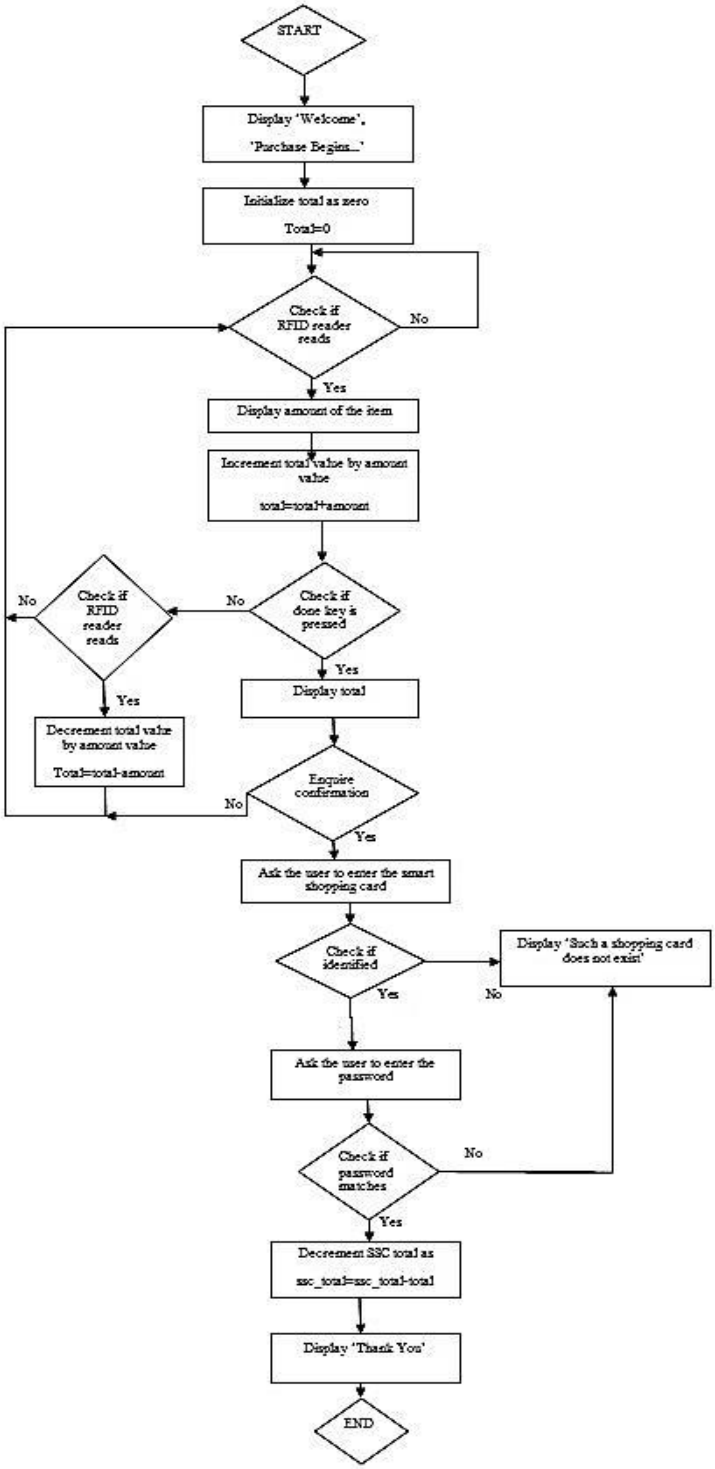

Fig.3. Flow-chart of Billing System

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Motor control section (Fig.2) begins with IR sensor detection. The IR sensor detects the IR transmitter which the customer will have in hand thus facilitating the left and right tyre movement. If Left (L) sensor reads, L tyre goes high. If Right (R) sensor reads, R tyre goes high. If Centre(C) sensor reads,L and R tyre goes high. In the obstacle detection part, if the distance between obstacle and trolley is less than 50cm, L and R tyres goes low(i.e. the trolley stops).

In the billing section (Fig.3), as the purchasing starts total is initialized as zero. When an item is added to the cart, the RFID reader detects code and hence the item, size, weight, price etc. When the reader detects the item, the total value gets added up with the amount of the item purchased. We have provided a done key to let our smart trolley know whether the purchase is done. If customer presses the key shopping will be terminated after the approval of confirmation message otherwise shopping will be continued. Then customer is asked for the SSC which again works on the RFID technology. If the card is identified, the user will be asked to enter the password of the SSC or else a message pointing out the non-existence of the card is displayed .If the password is correct the total amount in the shopping card will be reduced by the amount to be purchased or else a message pointing out the non-existence of the card is displayed.

V. EXPERIMENTAL RESULTS

The paper was done by using the processor Arduino UNO, IR transceivers as the communication medium between the trolley and the user, two 12V DC motors, an RFID reader and tags for identification of items, a hex keyboard for inputs and an LCD display to make the cart smart enough. The program was burned into the arduino board and was made to work by the circuit connections.

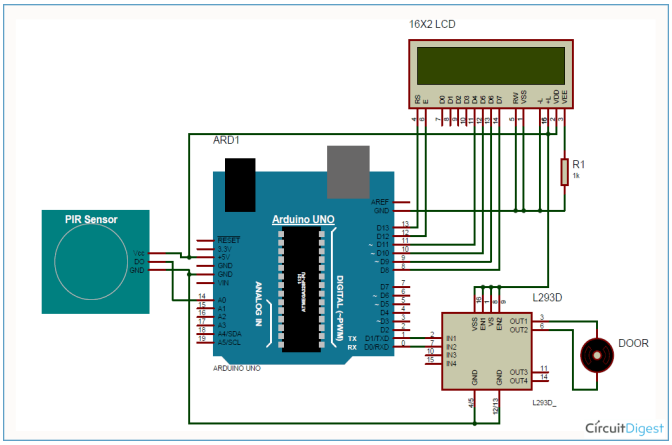

Fig.4. Connection Diagram

Fig.5.Image of Hardware

The trolley made is simple, economical and user-friendly that it can make its way easily into the shopping malls and margin-free markets where the queues and billing system retards the traditional shopping methods thus forcing them go online for shopping. Well, the Solution is The Smart Trolley with Advanced Billing System.

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VI.CONCLUSION

The desired objectives were successfully achieved in the prototype model developed. The developed product is easy to use and economical. Though the paper showcases the proof of concept, there are a few aspects that can be included to make the smart shopping cart more robust. The paper extends a different method of customer following, thus decrementing the hardware usage and inconvenience of customer to be path conscious instead of the traditional line following method. Furthermore, the system is completely user-friendly and free of the hectic queues and billing system providing a whole new shopping experience for the users.

VII.FUTURE SCOPE

In this paper the latency time of the wireless communication with the server may need to be considered. Secondly, a secure communication with server will be much more convenient. Another ZigBee module operating at the same frequency can easily intercept the transmitted data [2]. This issue will have to be resolved to promote consumer confidence. Further, a more sophisticated micro-controller and larger display system can be used to provide better consumer experience.

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