JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Design Of Smart Shopping Cart System

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***Abstract*—** This paper introduces an innovative approach to streamline the shopping experience in supermarkets by implementing an automatic shopping cart system. This smart shopping cart aims to reduce the time and effort customers spend during their shopping trips. It relies on an Arduino Mega microcontroller, RFID technology for product scanning, Bluetooth modules for cart control, DC motors for autonomous cart movement, and an LCD display for real-time billing information. The system is cost-effective, energy-efficient, and allows customers to enjoy shopping without manually pushing their carts.

***Index Terms*—Arduino Nano microcontroller, RFID reader, RFID scanner, LCD display(20X4), piezo buzzer**

I. INTRODUCTION

According to the current scenario, shopping in malls has become a daily routine. Shopping involves going to a store, examining the products, and going through the billing section, waiting in long queues, scanning the products, and finally paying the amount at the counter. However, sometimes people do not find it enjoyable. Today's supermarket shopping is very labor-intensive. Anything can be done to ease the burden that would be convenient to us. The customers always follow the same steps. Firstly filling the cart with items they wish to purchase, and at checkout time required them to empty the cart and put them on the conveyor belt. After that the cashier scans each and every item one by one to display the prices of the goods you purchase. And after this step all the goods need to be bagged and then each bag needs to be put back into a shopping cart for getting out from the supermarket. Thus, to overcome these problems we are establishing the idea of "Smart Radio-Frequency Identification based Shopping Cart System with smart care unit ". So, when a customer puts any product in a trolley the code of the RFID tag will be detected using a RFID reader which is connected to the trolley. Now customers can keep track of the total amount which they are buying and see LCD displays. In the billing section, it consists of Arduino Nano which has an inherited microcontroller and it is used at 5V. So, it helps to store the instructions and process accordingly and the microcontroller controls the whole process through the instructions stored. Smart care unit is used to take care of the child while doing shopping in crowded malls. Shopping trolleys will be installed with an RFID reader to help scan each product and load it which is controlled by a microcontroller.

II. LITERATURE SURVEY

[1] In 2020, a project was introduced with the aim of creating an affordable smart shopping cart called "A Novel Low-Cost Intelligent Shopping Cart". The purpose of this project was to assist customers in finding and selecting products while navigating the shopping complex. The smart shopping cart also provides customers with information about any available discounts or promotions. S. Sainath proposes a system for pervasive RFID-based shopping applications in his paper titled "Aisle-level Scanning for Pervasive RFID-based Shopping Applications." The system employs RFID reader antennas to scan both dynamic and static objects in a shopping area. Aisle-level scanning is conducted instead of observing RFID at the level of individual carts.

[2] In 2016, proposed a concept of having each product in a shopping complex to have a RFID tag on it and each cart to have an RFID reader. If the product is delisted, then it must be erased from the bill. There should be an RFID reader at the exit door for anti-theft. It will also display expiry date, product statistics and suggest alternatives. Thus, making use of this smart shopping system will become comfortable for users. It will also provide an anti thefts system for a supermarket and it will enable safety. It will also enable online transaction procedures for billing and also give suggestions to the user for buying products and display offers.

[3] In 2013, a proposal was made for the implementation of a shopping cart system that features automated billing. The system utilizes a wireless sensor network. The authors of the proposal explain how wireless sensor networks can be used to create a shopping cart that is reliable, cost-effective, and equitable.

[4] "Design and Implementation of an automated billing trolley" in 2022, Zigbee RF Modules was finagled to meet norms and support the very different requirements of affordable cost and less- power wireless detector networks. The modules demand minimum power and give dependable delivery of data between biases. The modules function within the ISM2.4 GHz frequency band and are leg- for leg compatible with each other.

[5] "Smart Cart For Automatic Billing With Integrated RFID System" in 2021, to tackle the issue of busy shopping counters, an automated smart shopping system is proposed, made to use a vital and unique concept of decipherable passive RFID tag. Every item in this system comes with an affordable RFID tag. When you place the item in a smart cart, the cart, which has an RFID reader, scans, and retrieves product details immediately. As a result, the billing process takes place right within the shopping cart, making it unnecessary for customers to wait in long queues at the billing counter. And also the cost of the item is displayed with all the additional and required details helping with social distancing norms by preventing crowd billing in the areas. At the end,the checkout point confirms the purchased things by the consumer.

[6] "Smart Shopping Cart System" in 2022. In this paper smart shopping cart was discussed. Smart shopping is done using RFID and Arduino UNO. The hardware model was designed such that the customers could pay the bill themselves online without waiting in queues near billing counter. The advantages and applications of smart shopping over traditional shopping are significant. The security analysis is also possible by Confidentiality, Integrity, Replay Attack Resistance, One-Time Key and Tag Security.

[7] "Development of Automatic Shopping Trolley in Supermarkets", in 2018. Automatic shopping trolleys developed on paperwork with very low cost as well as use less power for its operation. Using that, customers can love and enjoy shopping with their families. A module used on the trolley that give instructions to the trolley, DC Motors are used in the trolley and maintains a distance and it will move according to the customer's instructions of start and stop commands and there is a also a RFID reader fixed on the trolley which will keep the track of the total bill to ensure the customer's ease of pay.

[8] "RFID Based Smart Trolley for Automatic Billing System", in 2020. The payment process for clients and their shopping experience can be made faster and more efficiently if we use the RFID technology, RFID tags, Arduino and an EM-18 reader . This system can be implemented in retail malls with high footfall and a significant number of customers. This technology is a significant advancement in automation, and it supplants the current barcode technique that is being used. Using RFID technology, customers can simplify their shopping experience, save time, and reduce the need for extensive human involvement. Additionally, this technology reduces the need for human resources and

minimizes the shopping center's maintenance requirements.

[9] "Smart Shopping Using Lifi", the system creates the automatic system to identify the items purchased from a shopping cart, RFID technology is used. This method enhances security and is overseen by inspecting the items in the cart and cross-referencing them with the items on the bill. The billing process is automated through the implementation of LI-FI technology, elevating the complete shopping experience to a threshold. The main objective of this system is to provide a highly efficient and time-saving technique for billing, surpassing the time consumption of all existing billing methods. This approach enhances efficiency by minimizing consumer waiting time and decreasing staffing needs in malls. Various parameters of the smart shopping cart, such as product name, product cost, and product weight, are consistently displayed. This makes shopping more convenient.

[10] "RFID Based Smart Shopping and Billing", The constructed prototype model effectively accomplished its desired goals. The device is affordable, easy to use, and doesn't require any specific training. First of all, in this project the wireless connection's delay time to the server may be something to think about. Furthermore, the correspondence is inadequately safe. An additional ZigBee module in use at the same frequency can readily head off the data being delivered. The matter needs to be addressed categorically with respect to billing in order to encourage customer trust. Moreover, an enhanced display system with an advanced microcontroller can be applied to deliver improved customer service.

[11] "A Review on the Smart Cart Shopping System by Using IOT". In this research, we present an RFID-based secure smart shopping system. For the first time, UHF RFID is used to improve the shopping experience, and security concerns are talked about within the framework of a smart retail system. In order to test a system's functionality, a full system design and prototype are created. A well specified and protocol based communication is also designed, and security analysis and interpretation assessments are presented. It is anticipated that RFID technology will permeate future retail spaces, and our study represents a groundbreaking contribution to the creation of a smart shopping experience. In the future studies we will concentrate on making the existing system more efficient , such as lowering the power consumption and computational data rate at the smart cart side for increased effectiveness, and make communication more efficient.

[12] RFID system. The cart is intelligent since it has a ZigBee transceiver and an RFID reader in it. When an object is in the designated range, the RFID reader reads its ID. Using it makes the purchasing procedure simple and intuitive. the mobile phones. The centralized system's implementation is completed, and the product's specifications, expiration date, and price available inventory and comparable goods at comparable prices are kept and will eventually be shown on the smartphone at the time of the customer's purchase. In autopilot the billing system ensures that the customer stays within their budget. Additionally, stay clear of lengthy lines in front of the billing counters. We suggest utilizing the trolley's motion.

III. METHODOLOGY

A. RFID or Radio Frequency Identification System

It is a technology that uses radio waves for transmitting data between a reader and an electronic tag that is attached to a commodity or person for tracking and identification..

RFID advantages over barcodes are listed below-

1. It provides automation and real time tracking .

2. RFID tags are reusable.

3. RFID can store more data than barcodes.

4. RFID tags are more durable as compared to barcodes in extreme environments.

5. RFID systems have the capacity to read multiple tags simultaneously.

In the RFID system ,RFID labels which have the labelled data of the object generate a signal containing separate data, which is read by the RFID , and it can also pass this required information to the processor for recycling attained information required for that operation. A RFID label is composed of an transmitter, a wireless transducer and an recapitulating materials. These markers may be functional or liable,whereas functioning markers have their chip power, whereas liable markers use the power convinced by the glamorous field of the RFID anthology. Therefore, unresistant markers are cheaper but they have low range less than 10 mts and by comparison to active tags they are sensitive to regulate environmental constraints. Antenna, transceiver, and decoder are the three components that make up an RFID reader. These parts work together to send signals that query nearby tags. After receiving signals from tags it starts sending information to the data processor, and by processing subsystems it provides and stores the data.

PARAMETERS	RFID	BARCODE
Ability to read and write	It can read, write, and alter.	It only reads.
Line of Sight	Not necessary	Necessary
Durability	High	Low
Rate Of Reading	It possesses the ability to read multiple tags at once.	It reads only single tag.
Security	High	Low

Algorithm

Step-1: Begin.

Step-2: As the system initializes it starts to display initial data on it..

Step-3: scanning of the RFID membership card.

Step-4: And after scanning the membership card it retrieves all the personal information and then displays it over the LCD screen. And if the scan fails prompt the user to rescan the card. Repeat until the scan is successful.

Step-5: Prepare for product scanning, if scanned product code is identified, it displays all the product details over the LCD screen and if the product is not detected, prompt the user to scan it again. Repeat until the product is detected. In every product you have to apply the same

rules.

Step-6: And if any product that has been already scanned , by mistakenly it scanned again, then delete it from the microcontroller memory and from the current bill.

Step-7: After completing the shopping process customers must scan their membership card and If the card scan is successful, it displays a summary of the bill on your LCD screen.

Step-8: And once the bill amount is deducted from the card, send a text message to the customer designated mobile phone via the GSM module, providing information about the purchasing transaction

Step 9: End.

Step 10: If another membership card is scanned and detected, repeat the entire procedure.

B. TOOLS USED

a) ARDUINO NANO

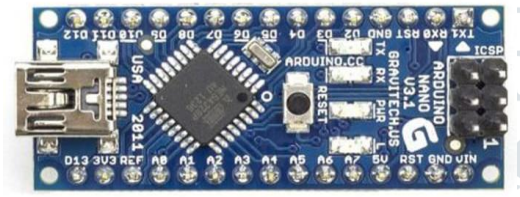


Fig.1 Microcontroller

The microcontroller is the main component as shown in the block diagram and it also operates at 5V. The microcontroller stores and processes instructions to control the entire process based on the stored instructions.

b) GSM MODULE

Fig.2 GSM MODULE

GSM module is basically a hardware component used to communicate electronic devices over GSM network; these modules consist of GSM modem .It supports communication within the band limit of 900MHz. In India most of the mobile network operates on a frequency of 900MHz. So , it is a very important requirement to check the mobile network band in your locality. The required frequency changes in different countries for example in the USA generally mobile networks operate on 850MHz but while considering the case of canada it is 1900MHz It has a wide range of application in various sectors like healthcare, security systems and specially in IOT devices.

c) LCD (LIQIUD CRYSTAL DISPLAY)

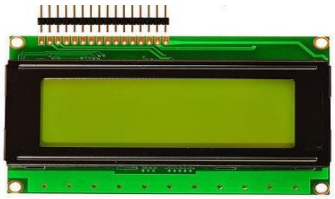


Fig. 3 LCD(20x4)

An LCD , A demitasse display is a flat panel display device that uses the liquid chargers light modulating packets paired with polarizers. This display is used in this model for displaying the result of scrutinized and total quantum of bills generated.

d) BUZZER

Fig. 4 PIEZO BUZZER

Here, in this model we used a piezo electric buzzer, a piezo buzzer is basically an electronic sounder that uses the piezoelectric effect in order to produce sound. It consists of ceramic disc which basically vibrate or produce sound when we apply electric signals to it. This buzzer has a piezoelectric component as its defining feature. A piezoelectric component is made up of unique materials that exhibit the piezoelectric phenomenon that is ceramic which basically respond by generating electric charge to acknowledge mechanical stress. The sound of the piezo buzzer is basically estimated or determined by the design and the construction of piezoelectric element and resonant cavity. It has some advantages like compact in size, lightweight has low power consumption.

e) RFID TAG and READER

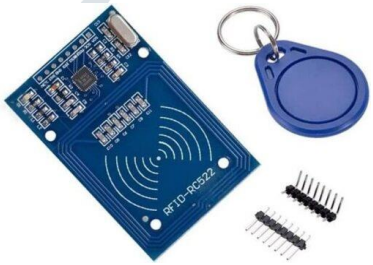


Fig.5 RFID TAG AND READER

RFID tags are basically chip or integrated circuit which is used to store data and it also include unique identifier for identification process .RFID reader is very similar to RFID tags where its sends or receive signals .It is basically used to analyse the data that is received by the tag and communicate it with the other system .They both comprises the RFID technology which is very useful for tracking , security system and also with Alzheimer's patients complaints.

SMART CARE UNIT

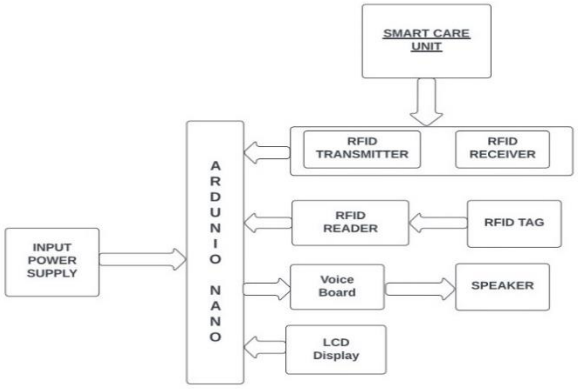
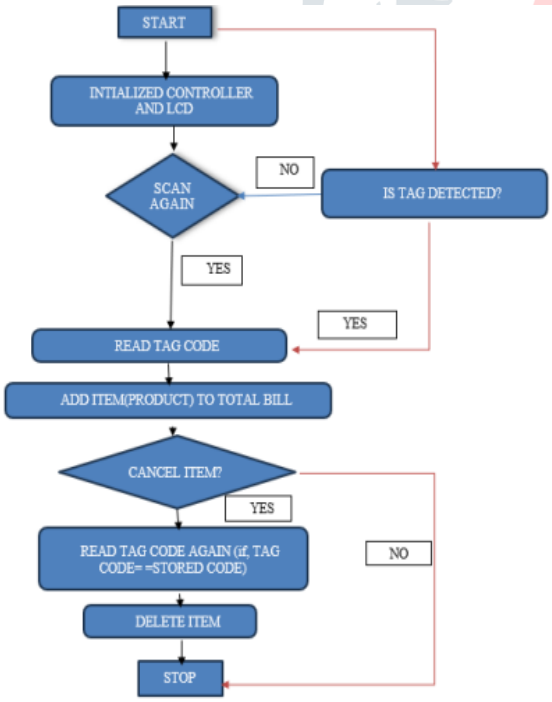


Fig.6 Block Diagram of RFID smart shopping cart with mart care unit

In this smart trolley design ,we have added a new feature known as a smart care unit. Basically, this unit is used to take care of the child while shopping in highly crowded malls. When your child moves away from the trolley after a certain distance the extra RF module that we have added to the trolley starts its action . buzzers start to produce sound . So that the parents get informed to protect their children in the shopping mall as it is very difficult to find the child in a crowded place.

FLOW CHART



SYSTEM OVERVIEW

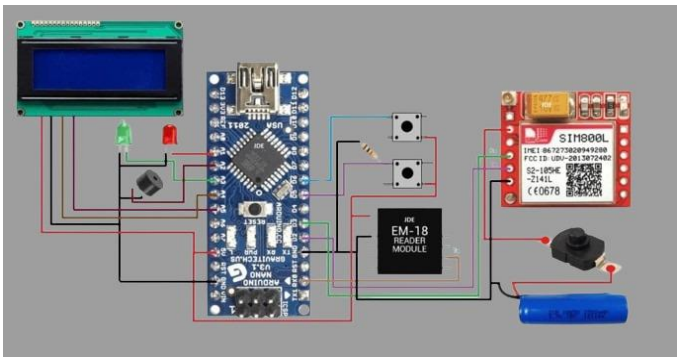


Fig.7 Circuit Diagram

We have designed a model which incorporates the long and tedious billing system of barcodes in shopping malls/complexes into a single and smart cart using RFID technology. In this model we have used a RFID reader based shopping cart and a RFID based tag on the product, each customer who wishes to shop is given a membership card with his/her details to begin shopping, they can simply scan product's tag against the cart's reader to add products with their prices in the microcontroller's(Arduino Nano) memory, they can also delete any product by scanning it twice. After customers have completed shopping, they are required to scan their membership cards again. Once the card of membership is scanned twice the entire bill will be sent on the customer's cell phone. To make this project further useable we have also connected a smart care unit for children. Basically, this unit is used to take care of the child while shopping in highly crowded malls. When your child moves away from the trolley after a certain distance the extra RF module that we have added to the trolley starts its action. buzzers start to produce sound. So that the parents get informed to protect their children in the shopping mall as it is very difficult to find the child in a crowded place.

CONCLUSION

This paper provides the design of the smart shopping cart system. It also includes a special feature known as a childcare unit. As we all know, smart shopping trolleys are becoming part of daily life. In this design we are using RFID technology. This technology makes shopping experience much easier, and time saving without any human intervention and also tackles the shopping mall maintenance problem. Basically it simplifies the shopping process by making it very fast to all the consumers and surely makes everyone rely on the system.

ACKNOWLEDGMENT

We would like to sincerely thank Dr. Shubham Shukla, our design mentor and guide, from the department of Electronics and Communication Engineering at KIET, for his guidance with unmatched knowledge. We are also thankful to Mr. Salim, from the department of Electrical and Electronics Engineering, KIET for furnishing us with the needed installations design work.

REFERENCES

[1] Mr. Mani. A, Aishwarya.D, Logeswari.M, Mythili.R. "Efficient Id Based Secured Trolley System Using Cloud Computing". International Journal of Engineering Applied Sciences and Technology, Vol. 4, Issue 11, 2020.

[2] Ankush Yewatkara, FaizInamdarb, Raj Singh, Ayushyad, Amol Bandal, "Smart Cart with Automatic Billing", Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft", International Conference on Communication, Computing and Virtualization 2016.

[3] Udita Gangwal, Sanchita Roy, Jyotsna Bapat, "Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks", Institute of Information Technology, 2013.

[4] Sachin K, Annapurna Halemani, Archana H N. Bhavana B, Gouri R S, "DESIGN AND IMPLEMENTATION OF AN AUTOMATED BILLING TROLLEY" in 2022, AUTOMATED BILLING TROLLEY",
International Journal of Creative Research Thoughts (IJCRT), © 2022 IJCRT | Volume 10, Issue 5 May 2022 | ISSN: 2320-2882. http://ijcrt.org

[5] Shaikh Farhan Shahnoor1, Ravi Kumar, Manish Rathore, Shivashish Saha, Raji C, "Smart Cart for Automatic Billing With Integrated Rfid System", Turkish Journal of Computer and Mathematics Education V ol.12 No.12 (2021).

[6] "Smart Shopping Cart System", Snehal Kulkarni, Dr. Supriya Shanbhag, Tejaswini Kamat, Tejaswini, International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 2, Issue 1, December 2022, ISSN (Online) 2581942 Gogte Institute of Technology, Belagavi, Karnataka, India.

[7] Rajini.H, Sandeep Jaiswal, Shyam sunder Prasad Kushboo, Anjela Kadiem, "Smart Cart for Automatic Billing with Integrated Rfid System", International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 23 (2018) pp. 16545-16547. © Research India Publications. http://www.ripublication.com

[8] G Manmadha Rao, K Preethi, A Sai Krishna, Afreen Firdaus, Ch Lokesh, "Rfid Based Smart Trolley for Automatic Billing System", international Journal of Recent Technology and Engineering (IJRTE), ISSN: 2277-3878 (Online), Volume-9 Issue-1, May 2020.

[9] Mrs. C. Sivamani , E. Pavithra , R. Thamarai selvi, Senthil kumar, "Smart Shopping Using Lifi", International Journal of Latest Engineering and Management Research (IJLEMR)ISSN: 2455-4847www.ijlemr.com || Volume 02 - Issue 11 || November 2017.

[10] Zeeshan Ali, Reena Sonkusare, "RFID Based Smart Shopping and Billing" International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 12, December 2013.

[11] Anusha B G, Dr Nagaveni V, Smart Cart Shopping System Using IOT, Journal of Networking, Computer Security and Engineering, Volume 4 Issue 1, 2019.

[12] Mrs. Anju V Abraham, Ms. Aiby Ann Abraham, Mr. Nikhil Varghee, Mr. Vignesh Prabhu, Ms. Hima Kurian, "SMART SHOPPING CART", JETIR May 2019, Volume 6, Issue 5, http://www.jetir.org, (ISSN-2349-5162).

[13] Alexander A S Gunawan et al. / Procedia Computer Science 157 (2019) 629–637, "Development of Smart Trolley System Based on Android Smartphone Sensors", 1877-0509 © 2019 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/) Peer-review under responsibility of the scientific committee of the 4th International Conference on Computer Science and Computational Intelligence 2019.

[14] Akindele E. Ayoola, Member, IAENG Awodeyi I. Afolabi, Victoria W. Oguntosin, Olaitan A. Alashiri, Victor O. Matthews, Member, IAENG and Odunayo O. Akande, "Development of an Intelligent Smart Shopping Cart System", Proceedings of the World Congress on Engineering and Computer Science 2019 WCECS 2019, October 22-24, 2019, San Francisco, USA.

[15] K. Venkata Sai Prasad, K. Karthik, O. Charan Kumar1, Prathiksha B S, and Kavana Salimath, ICISPES-2023 IOP Conf. Series: Materials Science and Engineering.

[16] Manchukonda Gautham, Pothapala Vinodh, Syed Vaseem, Darwin Nesakumar, "Radio Frequency Identification Based Smart Shopping Trolley", IJARIIE-ISSN(O)-2395-4396, Vol-5 Issue-2 2019.

[17] Prof. Roopa C, Nivas Chandra Reddy, "Research on Smart Shopping Cart", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN: 2456-330, Volume 6, Issue 4 Page Number: 1-10 Publication Issue : July-August-2020.

[18] Jonathan Albert, Willy Harianto, Gabrielle Halim, and Geraldo Rafael, Lithrone Laricha Salomon, Lina Gozali, Frans Jusuf Daywin, Helena Juliana Kristina, Andres, Agustinus Purna Irawan1, Harto Tanujaya, "Smart Trolley as Sophisticated Supermarket Facility in Covid-19 Pandemic Era", Proceedings of the Second Asia Pacific International Conference on Industrial Engineering and Operations Management, Surakarta, Indonesia, September 14-16, 2021.

[19] Amna Khamis Salim Al Hakmani Ajitha Sajan, "Design and Implementation of a Smart Shopping Trolley Using RFID Technology", Journal of Student Research Fourth Middle East College Student Research Conference, Muscat, Sultanate of Oman, 2020

[20] Maham Kamil Naji, Alaa Desher Farhood, Hayder Fadhil Fahad, Adnan Hussein Ali, "A radio frequency identification based smart shopping trolley system for automated billing", Bulletin of Electrical Engineering and Informatics Vol. 12, No. 6, December 2023, ISSN: 2302-9285.