

Design and Implementation of Secure Smart Shopping System using Arduino



R. Parameswaran, P. T. V. Bhuvaneshwari

Abstract: *The contemporary electronic technology is based on embedded system which deals with integrating numerous transistors on a single silicon chip. The main goal of growing technology is to make lifestyles turn out to be simpler and more comfy. Nowadays, people like visiting shopping malls that are characterized by their colorful variety and heterogeneity besides beauty. A shopping center is where people can discover all kinds of shops including eateries and cinema under one roof. In shopping malls, people can purchase the groceries, fruits, etc., so it requires a trolley to carry the things they purchase. Every time consumers have to make some calculations regarding those items & need to compare them with their budgets. After this procedure, the customer must wait for the billing. So to avoid the boredom of waiting in the billing queue our research proposal has been carried out on a novel concept that is "Smart Shopping Using Smart Trolley". In this proposed work uses RFID tags to be displayed on the product. Whenever the customer places a product in the trolley, the RFID reader will check it and the price and cost of the product will be displayed on LCD display. The main advantage of this work is that it provides for the caring of child that the customer may bring and so it has introduced a child unit. It comprises of RF module that is used as a transceiver and once the child moves away from the customer through the parent it may get some indication. When the child moves from the trolley through a certain distance, the LED which is placed in the cart turns off. After the completion of shopping, billing can be done using QR code that is pasted either on the trolley or at the exit point.*

Key Words: *Child unit, LCD Display, RFID reader, RFID tags, RF module.*

I. INTRODUCTION

The human life-style has changed due to the tremendous growth of technology. Human life has come to be rapidly moving and hectic. For today's generation, time is money. Therefore, except in stores, individuals do not have much time to spare. There are two types of buying: one is shopping in person by folks and the other is online shopping. Mostly customers decide upon shopping in the department stores or large shops in malls. People get regular requirements at the same place, such as clothing, vegetables, and many other items. This saves them a lot of time so they do not have to go to different stores to buy different things. During vacations and festive times people visit in large numbers and after purchasing they have to be standing in long queues for the billing of their purchased items.

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In the billing process the shop keeper scans the barcode of each and every product and it also takes a lot of time. The whole process is time consuming. To make this complex process a simple one we format a smart trolley. This clever trolley consists of an RFID reader which reads the products with the aid of capacity of RFID tag.

It consists of voice board and baby unit. Voice board tells the product name using speaker and it is displayed in LCD along with its cost and expiry details. The child unit intimates the consumer if the child that has been brought has moved away from the cart through LED. LED gets turned off if the sign is misplaced from RF transmitter which is with the child. Thus toddler unit helps track the child as the unit gives alert. If clients want to eliminate the product from the cart that they have taken, they can do it by the use of a key. Once purchasing is over, the total amount will be displayed in the LCD and billing can be accomplished by using QR code. At the exit point checking of consignment and packing of merchandise can be done. In order to make shopping less difficult for shoppers in malls/shops, there have been a number of strategies planned for clever purchasing trolleys. By eliminating waiting in lengthy billing lines, it saves customer time. This clever trolley also lowers the strength of the man. This machine is efficient and easy to use.

II. MATERIALS AND METHODS

R. Kumar et al., [1] have proposed "Intelligent shopping cart". In this paper, the researchers have discussed the product "Intelligent Shopping Cart" This is intended to support a customer shop on a regular basis in terms of decreased buying time. Three main components/modules are included in the evolved framework, namely the Server Communication Component (SCC), the User Interface and Display Component (UIDC) and the Automated Billing Component (ABC). It shows the integration of three modules into an embedded device and tested to conform within the functionality. With proper attention to security and network problems, the built prototype is ready for commercial implementation. Zeeshan Ali et al., [2] have proposed "RFID Based Smart Shopping and Billing". In this paper, the authors put forward the innovative concept of RFID Based Smart Shopping and Billing. The built in framework comprises of Cart location detection unit (CLDU), Server Communication unit (SCU), and a Billing and Inventory management unit (BIMU). It consists of RFID, Wireless Zigbee Module, Infrared (IR) transmitter and receiver, RFID tags, Microcontroller, and Server module. Customers will be able to scan the products themselves and the LCD screen will continue to update the total amount of the products purchased.



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P.Chandrasekar et al., [3] in “Smart Shopping Cart with Automatic Billing System through RFID and Zigbee” has proposed to broaden a shopping cart with a Product Identification Device (PID) in order to include a microcontroller, an LCD, an RFID reader, EEPROM, and Zigbee module.

Purchasing product statistics will provide information and it can be read through an RFID reader on shopping cart, meanwhile product information can be stored into EEPROM attached to it and this EEPROM data can be sent to the central billing system through Zigbee module. The central billing system receives the cart information and EEPROM data and it accesses the product database and calculates the total amount of purchasing for that precise cart.

Ankit Anil Agarwal et al., [4] in “RFID Based Automatic Shopping Cart” They described the implementation of a system to allow a new way of shopping for the customer. The customer heads towards a shopping cart that has a technological system on its handle bar that consists of a touch-screen monitor, an automatic customer cart reader, a positioning transmitter and a product reader upon arriving at the supermarket. T. Shanmugapriyan [5] “Smart Cart to Recognize Objects based on User Intention”. This system provides a smart cart that is a reasonable mobile grocery store and supports shopping processes for clients. Mobile and pervasive technologies, smart carts, and sensors are needed in this framework. It consists of four key components, namely integration of hardware, interface of software, wireless communication and database of networks. The interactive trolley guides and directs shoppers to handle and manage the trolley. From the above literature review, it is found that shopping cart with only billing system has been used. Therefore, an effort was made to improve the trolley system for the child care unit in the proposed research. In this paper the main idea is to implement the billing system with secure shopping in stores and developing a prototype by using RFID based Trolley. This Trolley has LCD display, keypad, and Voice board. LCD displays added amount for each product an individual has purchased. Voice board gives information about each product like product name and also other offer details. so that the product’s duplication can be avoided. And also there is no need for guidance to explain the product details. Also we are using RF communication for child unit. If the child of the customer crosses a particular zone, then alerts will be given via LED. The advantages of this prototype are achieving a faster billing system and freeing customers from the botheration of standing in the queue. In addition, it allows the consumer to know the specifics of the bill in advance so that they can plan an affordable order. It will educate the consumer about current offers by voice board products and it is simple to use and needs no special training.

III. BLOCK DIAGRAM

The proposed methodology has been shown in figure.1 and it is having two modules: one module is with respect to trolley system and it will be having RF receiver. The other module has child care unit through which the child will be monitored by the parents during the shopping activity.

The operation of the block diagram can be explained thus: The Arduino board is provided with a 12V power supply, and then the Keypad, RFID reader, LCD, Voice board,

speaker, RF receiver that is connected with Arduino. The RF receiver is connected with 5th pin of Arduino. The Voice board is connected with 2nd and 3rd pins. Speaker is connected with the voice board. The keypad is connected with 6th pin. Serial communication is made through UART. The RFID reader Tx port is connected with Rx port of Arduino.

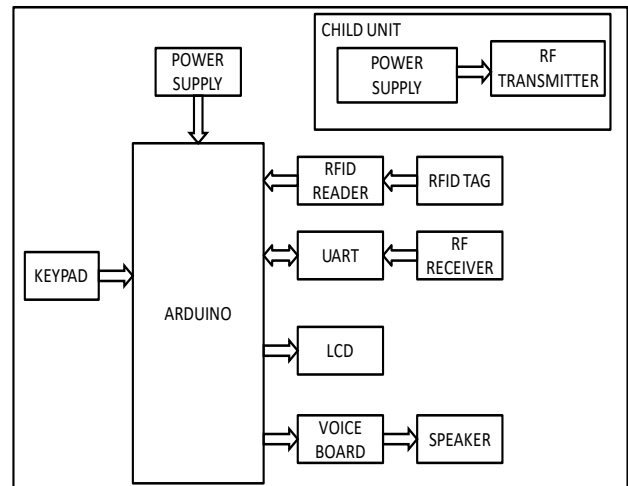


Fig.1 Block diagram of trolley system with child care unit

When power supply is switched on, the Arduino turns on and it is ready to perform the task. The RFID product tag is mounted on the RFID reader; it reads the specifics of the product and shows those details on the Arduino-connected LCD and transfers the information to the voice board supplied with the speaker that provides a voice message after processing. Along with this RF receiver which is connected with Arduino receives signal from the transmitter (which is with the child). It also consists of a reset button to start it. The model of smart trolley has been shown in figure.2.



Fig.2 Prototype of smart trolley system

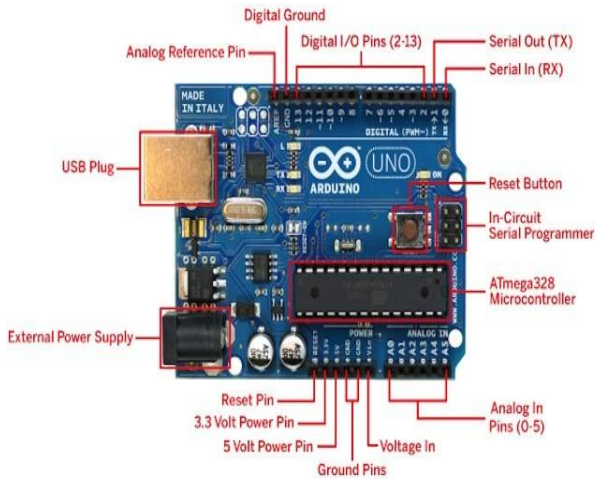


Fig.3 Arduino board

The Arduino [7] is free and easy-to-use software. It's a microcontroller that can help you solve problems. The board features 14 Digital input and output pins, 6 analog input and output pins and is programmed with a Form B USB cable with Arudino IDE software. A built-in LED powered by digital pin 13 is present. The LED is on when the pin is high, and it is off when the pin is low. An external power supply is used to input the voltage to the Arduino module (as opposed to 5 volts from the USB connection or other regulated power source). Via this pin, voltage may be supplied or, if voltage is supplied by the power socket, control is accessed via this pin. From the regulator on the board, this pin outputs a controlled 5V. The board can be operated either from the DC power jack (7 - 20V), from the USB connector (5V) or from the board's VIN pin (7-20V). The supply of voltage through the 5V or 3.3V pins bypasses the regulator, and the board can be impaired. The on-board regulator produces a 3.3 volt supply. The overall drawing current is 50 mA. The Arduino/Genuino Uno board is built in such a way that it facilitates resetting by software running on a linked device rather than requiring a manual press of the reset button before uploading. The reset line of the ATmega328 is attached to one of the hardware flow control lines (DTR) of the ATmega8U2/16U2 via the 100 nano farad capacitor. At the point when this line is declared (taken low), the reset line drops adequately long to reset the chip. Serial / UART: to receive (RX) and transmit (TX) TTL serial data, pins 0 (RX) and 1 (TX) are used. The corresponding pins of the ATmega8U2 USB-to-TTL serial chip are wired to these pins.

IV. RFID TRANSMITTER AND RECEIVER:

The RFID (Radio Frequency Identification Reader) [6] is a prototype used to capture the data from an RFID tag and is shown in figures 4(a) and 4(b) It is used for individual items to be found. To pass the information from the tag to a reader, radio frequency waves are used. To be understood, the RFID tag must be within the range of an RFID reader. RFID technology makes it easy to rapidly search many objects and allows a single product to be detected quickly, often though it is surrounded by several other items.



Fig.4 (a) RF Transmitter

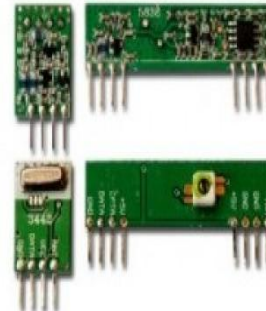


Fig.4 (b) RF Receiver

For remote control applications where reduced effort and longer range is needed, the RF 433 is ideal. The transmitter functions from a stockpile of 1.5-12V, making it ideal for battery-controlled apps. A SAW-balanced out oscillator is used by the transmitter, ensuring exact recurrence control for best execution of the spectrum. Yield force and consonant emanations are anything but difficult to govern, make accuracy convenient for FCC and ETSI. The well-disposed Taste type bundle assembly [lacks clarity] and limited effort makes the RF-433 appropriate for applications with high volumes.

V. VOICE BOARD

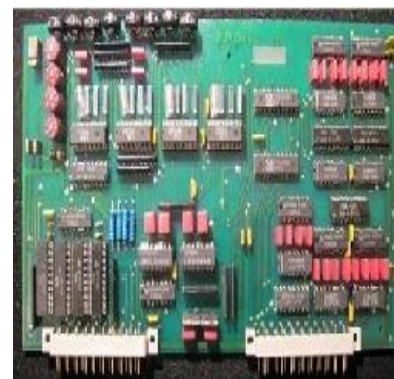


Fig.5 voice board

Voice board Corporation has built up an expansive line of implanted equipment and programming items and innovation offered to broadcast communications OEM fabricating organizations, framework integrators and military interchanges suppliers.

VI. LIQUID CRYSTAL DISPLAY

For liquid crystal display, LCD stands. It is a 2-line alphanumeric LCD monitor of 16 characters attached to a single 9-way D-type connector. This enables the system to be attached to most ports of the E-Block I/O ports. The product RFID tag is placed at the RFID reader; it reads the product details and displays those details in LCD that is connected with Arduino. It reads the product details as shown in Table.4.1 and displays in LCD.

TABLE.1 PRODUCT DETAILS DISPLAYED IN LCD

PRODUCT DETAIL	AMOUNT
1 Kg Rice	Rs.70
5 Kg Wheat	Rs.200
1 Kg Onion	Rs.30

VII. RESULTS AND DISCUSSION

Figure.6 illustrates the customized model of smart trolley system and it consists of Arduino, RF Transmitter, RF Receiver, LCD Display, and Child unit. In each product, the RFID tag is placed and the products are displayed near the RFID reader that reads and displays the product information in an LCD display. The voice board tells us about the product.

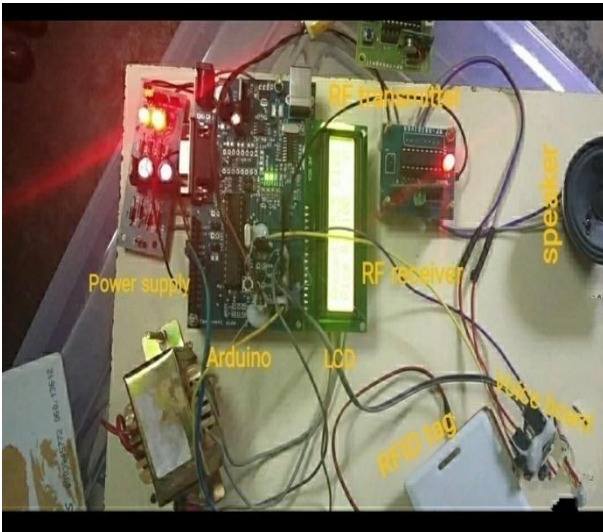


Fig.6 Output

The LCD [8] displays the prices of the products purchased. It displays the product details and if any product has expired, it will show to us through LCD and the total amount will be added and displayed as shown in figure.7



Fig.7 Display product details in LCD

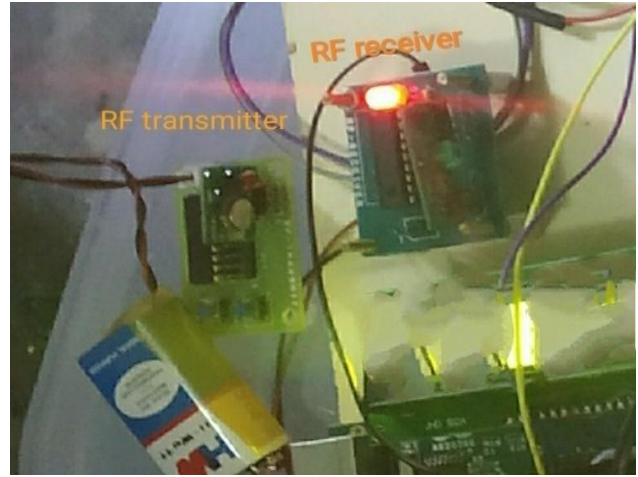


Fig.8 Child unit

As shown in Figure 8, to every trolley a child unit is attached with a RF receiver being placed with Arduino and a child will have an RF transmitter with him/her. If the child is away from the trolley, the RF receiver will blink off through an LED. QR Scanner is placed in a trolley or at the exit point to pay the bill via google pay and net banking and it is shown in figure.9.



Fig.9 QR Scanner

VIII. CONCLUSION AND FUTURE WORK

An Automated central billing system (ACBS) for super markets and malls is proposed by the smart shopping trolley. Customers would not have to wait near the cash counter to pay their bill using PID (Product Identification). Customers may still pay their bill via credit or debit cards as their bought product information is transmitted to the central billing system. The proposed work is highly accurate, authentic, deserving of confidence and time-efficient. It allows the owners of the shop to avoid additional charges. This method will be more efficient for the peoples and the shop owners too.

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