Journal of Advanced Research in Technology and Management Sciences (JARTMS)
Volume: 02 Issue: 03 ISSN: 2582-3078 May - June 2020
Available online at: http:// www.jartms.org

Smart Trolley Using RFID and ZIGBEE

T.Keerthi Reddy[1], E. Ranadheer[2], K.Roopa[3], Mrs. T. Kavitha[4], Y.David Solomon Raju[5]

Abstract **:** *Nowadays, buying and searching at huge malls is turning into a daily activity in subway cities. We can see large rush at malls on holidays and weekends. The rush is even a lot of once there are special offers and discounts. People purchase totally different things and place them in trolley. After total purchase one needs to go to cashier for payments. The cashier prepare the bill victimization bar code reader that could be a time overwhelming method and leads to long queues at charge counters. This paper targeted to minimize the Queue at a billing counter in a shopping complex. Smart Trolley does the same by displaying the total price of the product kept inside the cart. In this way the customer can directly pay the amount at the billing counter and leave with the commodities he/she has bought. The hardware is based on Arduino Uno, RFID Reader Module, RFID Card, Zigbee, Buzzer .It eliminates the traditional scanning of products at the counter and in turn speeds up the entire process of shopping, also with this system the customer shall know the total amount to be paid and hence can accordingly plan his shopping only buying the essential commodities resulting in enhanced savings. Since the entire process of billing is automated it reduces the possibility of human error substantially. Also the system has a feature to delete the scanned products by customer to further optimize the shopping experience.*

Keywords*: Arduino Uno, RFID Reader Module, RFID Card, Zigbee, Buzzer*

***** Correspondence Author
T.Keerthi Reddy[1]
E. Ranadheer[2]
K.Roopa[3],
[1,2,3]UG Student, Department of ECE,
Holy Mary Institute Of Technology And Science, Bogaram(V) Keesara(M), Medchal-501301
Mrs. T. Kavitha[4]
[4]Assistant Professor, Department of ECE,
Holy Mary Institute Of Technology And Science, Bogaram(V) Keesara(M), Medchal-501301
Y.David Solomon Raju[5]
[5]Associate Professor, Department of ECE,
Holy Mary Institute Of Technology And Science, Bogaram(V) Keesara(M), Medchal-501301

Smart Trolley Using RFID and ZIGBEE

1. INTRODUCTION

This paper aims in designing a user friendly, automatic shopping trolley and data storing system of the number goods on trolley in big shopping malls using RFID technology and display on the LCD (Liquid Crystal Display). Automation is the most frequently spelled term in the field of electronics. The hunger for automation brought many revolutions in the existing technologies. One among the technologies which had greater developments is RF communications. The result of this is the RFID cards which transmit a unique identification number. This number transmitted by the RFID can be read with the help of a RF reader. The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The RFID reader is interfaced with the ATMEGA328P microcontroller and RFID tag is attached to each and every good package. When the goods are moving on the trolley with the RFID tags attached to the goods are decoded by the RFID reader interfaced to the Arduino microcontroller and the information is stored and displayed on LCD. The system provides even audible alerts using buzzer alarm when the tag is placed onto the RFID reader. The paper consists of RFID module, LCD display, buzzer and ATMEGA328P microcontroller. The input module is the RFID reader which gives the information of the good when it decodes the RFID tag of the good, this information is displayed on the LCD. When the RFID tag of the good is decoded by the RFID reader it continuously monitors, which approaches near the system. The entire data related to goods are stored in the microcontroller and also displays on LCD.

Components Description:-

ATMEGA328 Microcontroller: The ATmega328 is a single chipmicro-controller created by Atmel and belongs to the mega AVR series. The Atmel 8-bitAVRRISC-based microcontroller combines 32 KB ISPflash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLFpackages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughputs approaching 1 MIPS per MHz .

- AVR Family microcontroller
- Operating Voltage 5V
- Digital I/O of Uno Pins 14
- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA
- SRAM 2 KB
- EEPROM 1 KB
- Clock Speed 16 MHz

Regulated Power Supply: Power supply is a supply of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. A power supply may include a power distribution system as well as primary or secondary sources of energy such as

- Conversion of one form of electrical power to another desired form and voltage, typically involving converting AC line voltage to a well-regulated lower-voltage DC for electronic devices. Low voltage, low power DC power supply units are commonly integrated with the devices they supply, such as computers and household electronics.
- Batteries.
- Chemical fuel cells and other forms of energy storage systems.
- Solar power.
- Generators or alternators.

LED: A light-emitting diode (LED) is a semiconductor light source. LED's are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LED's emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness. The structure of the LED light is completely different than that of the light bulb. Amazingly, the LED has a simple and strong structure. The light-emitting semiconductor material is what determines the LED's color. The LED is based on the semiconductor diode. When a diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of the light (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor. An LED is usually small in area (less than 1 mm^2), and integrated optical components are used to shape its radiation pattern and assist in reflection. LED's present many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved

robustness, smaller size, faster switching, and greater durability and reliability. However, they are relatively expensive and require more precise current and heat management than traditional light sources.

RFID: RFID is an acronym for Radio Frequency Identification. RFID (radio frequency identification) is a technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal, or person. RFID is coming into increasing use in industry as an alternative to the bar code. The advantage of RFID is that it does not require direct contact or line-of-sight scanning.
An RFID system consists of three components: an antenna and transceiver (often combined into one reader) and a transponder (the tag). The antenna uses radio frequency waves to transmit a signal that activates the transponder. When activated, the tag transmits data back to the antenna. The data is used to notify a programmable logic controller that an action should occur. The action could be as simple as raising an access gate or as complicated as interfacing with a database to carry out a monetary transaction.
Low-frequency RFID systems (30 KHz to 500 KHz) have short transmission ranges (generally less than six feet). High-frequency RFID systems (850 MHz to 950 MHz and 2.4 GHz to 2.5 GHz) offer longer transmission ranges (more than 90 feet). In general RFID is the higher the frequency, the more expensive the system. RFID is sometimes called dedicated “short range communication (DSRC).Radio Frequency Identification (RFID) is a means of identifying a person or object using a radio frequency transmission. The technology can be used to identify, track, sort or detect a wide variety of objects.
Communication takes place between a reader (interrogator) and a transponder (tag). Tags can either be active (powered by battery) or passive (powered by the reader field), and come in various forms. Some variants of tags and readers are shown RFID Tag and RFID Reader respectively. The communication frequencies used depends to a large extent on the application, and range from 125 kHz to 2.45 GHz.

RFID TAGS: In its basic form, an RFID tag consists of a silicon integrated circuit (an “IC Chip”) connected to a small antenna.There are two general categories of RFID tags, passive tags and active tags. The most common of these is a “passive” tag (shown above), so-called because it has no internal battery power. Instead, passive tags are powered by energy drawn from the RF carrier wave transmitted by the interrogator.
The modulated carrier wave transmitted by the interrogator is sensed by the Antenna. The carrier wave induces a small alternating current (AC) in the Antenna. Inside the IC Chip a Power Rectifier and Regulator converts the AC to stable DC and uses it to power the IC chip, which immediately “wakes up”. The Clock Extractor separates the clock pulses from the carrier wave and uses the pulses to synchronize the Logic, Memory, and Modulator sections of the tag’s IC chip with the Interrogator. Printed barcode labels generally conform to the Universal Product Code standard (UPC) of product identification. RFID tags used to identify products in the supply chain serve the same purpose, so it’s often expeditious to explain RFID tags simply as ″electronic barcodes.″ Both RFID tags and barcode labels digitally convey information about objects. Currently, ″Class 1+″ RFID tags are available with a digital memory of 96 bits, each bit being either logic 1 or a logic 0. Because alphanumeric characters (i.e., A-to-Z and 0-9) each require 8 bits of memory, it’s possible to store 12 characters in an RFID tag (which isn’t saying much). On the other hand those 96 bits represent a possible 79,228,162,514,264,300,000,000,000,000 (that’s over 79.2 trillion) unique numerical identities.

LCD Display: One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCD’s connected to the many microcontrollers are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.The LCD requires 3 control lines as well as either 4 or 8 I/O lines for the data bus. The user may select whether the LCD is to operate with a 4-bit data bus or an 8-bit data bus. If a 4-bit data bus is used the LCD will require a total of 7 data lines (3 control lines plus the 4 lines for the data bus). If an 8-bit data bus is used the LCD will require a total of 11 data lines (3 control lines plus the 8 lines for the data) The three control lines are referred to as **EN**, **RS**, and **RW**.The **EN** line is called "Enable." This control line is used to tell the LCD that we are sending it data. To send data to the LCD, our program should make sure this line is low (0) and then set the other two control lines and/or put data on the data bus.

ZIGBEE Technology: ZigBee technology will be embedded in a wide range of products and applications across consumer, commercial, industrial and government markets worldwide. For the first time, companies will have a standards-based wireless platform optimized for the unique needs of remote monitoring and control applications, including simplicity, reliability, low-cost and low-power”.The target networks encompass a wide range of devices with low data rates in the Industrial, Scientific and Medical (ISM) radio bands, with building-automation controls like intruder/fire alarms, thermostats and remote (wireless) switches, video/audio remote controls likely to be the most popular applications. So far sensor and control devices have been marketed as proprietary items for want of a standard. With acceptance and implementation of ZigBee, interoperability will be enabled in multi-purpose, self-organizing mesh network.
Though WPAN implies a reach of only a few meters, 30 feet in the case of ZigBee, the network will have several layers, so designed as to enable interpersonal communication within the network, connection to a network of higher level and ultimately

an uplink to the Web. The ZigBee Standard has evolved standardized sets of solutions, called ‘layers'. These layers facilitate the features that make ZigBee very attractive: low cost, easy implementation, reliable data transfer, short-range operations, Very low power consumption and adequate security features.

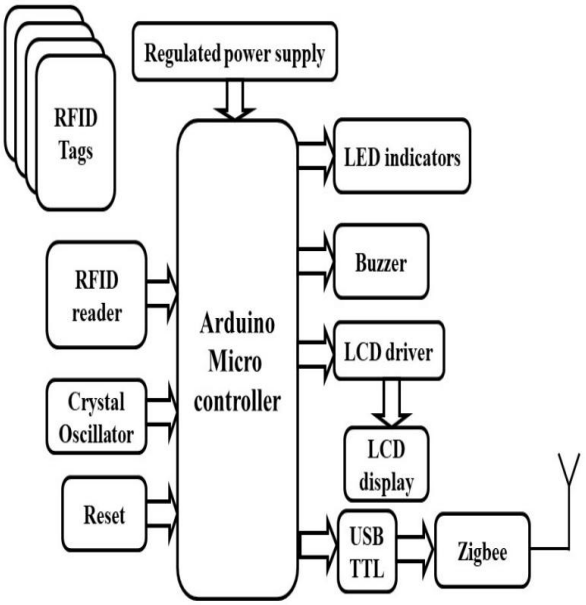
Buzzer: Basically, the sound source of a piezoelectric sound component is a piezoelectric diaphragm. A piezoelectric diaphragm consists of a piezoelectric ceramic plate which has electrodes on both sides and a metal plate (brass or stainless steel, etc.). A piezoelectric ceramic plate is attached to a metal plate with adhesives. Applying D.C. voltage between electrodes of a piezoelectric diaphragm causes mechanical distortion due to the piezoelectric effect. For a misshaped piezoelectric element, the distortion of the piezoelectric element expands in a radial direction. And the piezoelectric diaphragm bends toward the direction. The metal plate bonded to the piezoelectric element does not expand. Conversely, when the piezoelectric element shrinks, the piezoelectric diaphragm bends in the direction Thus, when AC voltage is applied across electrodes, the bending is repeated, producing sound waves in the air.
To interface a buzzer the standard transistor interfacing circuit is used. Note that if a different power supply is used for the buzzer, the 0V rails of each power supply must be connected to provide a common reference.
If a battery is used as the power supply, it is worth remembering that piezo sounders draw much less current than buzzers. Buzzers also just have one ‘tone’, whereas a piezo sounder is able to create sounds of many different tones.

To switch on buzzer -high 1
To switch off buzzer -low 1

USB-TTL Converter

- The CP2102 is a highly-integrated USB-to-UART Bridge Controller providing a simple solution for updating RS-232 designs to USB using a minimum of components and PCB space.
- Single-Chip USB to UART Data Transfer
- Integrated USB transceiver; no external resistors required
- Integrated clock; no external crystal required
- Integrated 1024-Byte EEPROM for vendor ID, product ID, serial number, power descriptor, release number, and product description strings
- On-chip power-on reset circuit
- On-chip voltage regulator: 3.3 V output
- 100% pin and software compatible with CP2101

Block Diagram & Working:



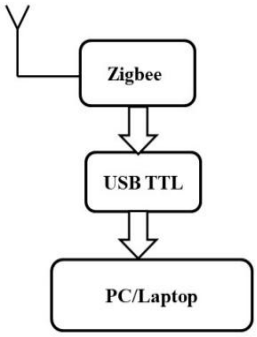
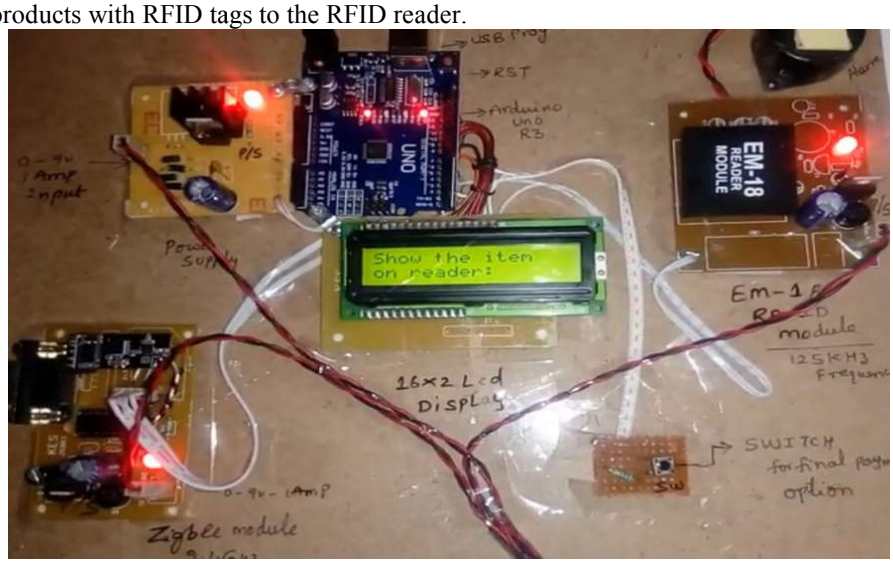


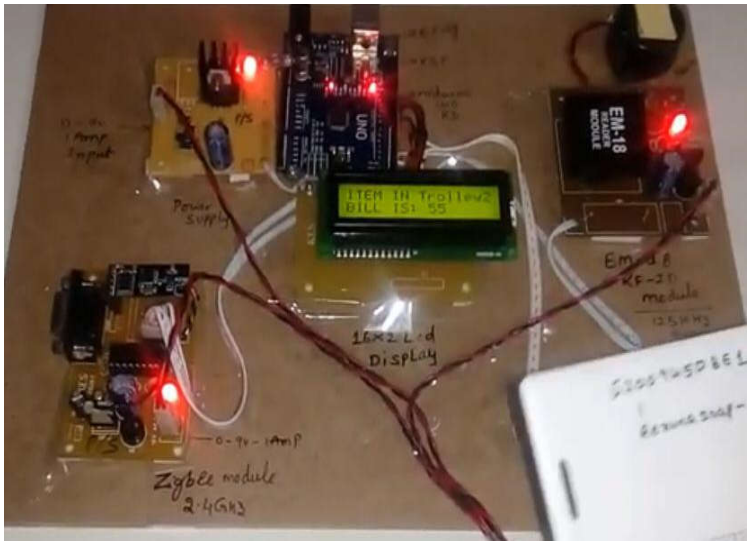
Fig: Block diagram Smart Trolley

- ✓ All the product information is stored in a database at a central server. The information received from the server is temporarily stored in the shopping card memory.
- ✓ 2. All the items in the mall will be equipped with RFID cards. When person puts an item in the trolley, its card will be scanned by the RFID reader.
- ✓ 3. Reader send this code to Arduino Uno which further reads item's name, cost & other details. Then it displays on LCD. The item details like name, price & total bill of things inserted in cart are displayed on liquid crystal display.
- ✓ 4. As we put the items, the costs will get added to total. Thus, the billing is done. Simultaneously all details are displayed on LCD.
- ✓ 5. If the customer need to 'cancel' a selected product, it can be accessed through swiping the product tag two times.
- ✓ 6. After completing the shopping, the customer has to select the "Finish" button.
- ✓ 7. This enables the total bill being generated after confirmed purchase of all the selected products in the shopping cart.
- ✓ 8.At the same time, this information is sent to the database server through the wireless "ZIGBEE" transmitter.
- ✓ 9.At the billing Counter, the total bill data will be transferred to PC by wireless ZIGBEE receiver.
- ✓ 10.Later the billing is carried out by master billing section. Finally the customer need to pay the total amount at the billing counter, so the queue problem is avoided

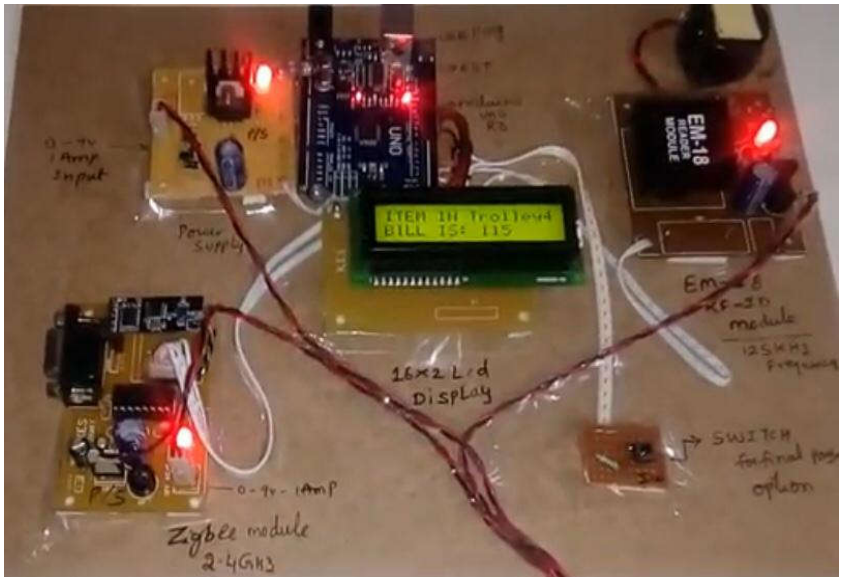
Results: Once the circuit is powered ON, Arduino sends commands to the LCD to display "Show the items to the reader" on LCD.Now scan the products with RFID tags to the RFID reader.

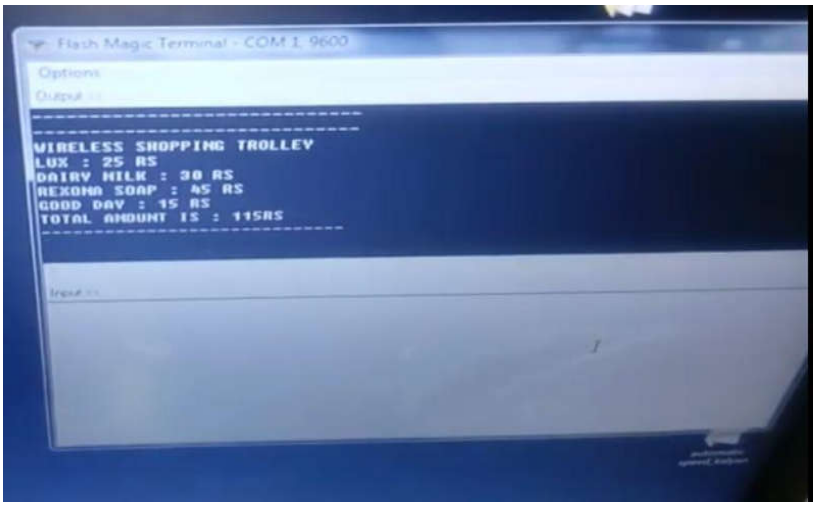


Now the customer can also scan any number of products he/she wants to. then the LCD will display the total number of products scanned and the total bill on the LCD screen.

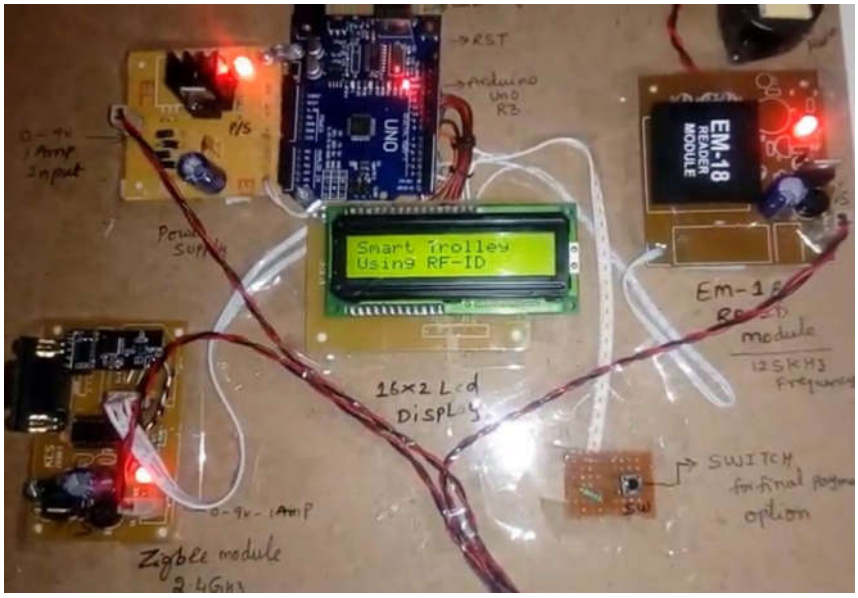


After the total number of products are scanned the final bill payments is sent to the counter side PC by using Zigbee transmitter from the trolley side to the Zigbee receiver on the counter side. where the receiver is connected to the PC by using USB TTL converter.





WORKING MODEL OF THE KIT



Conclusion: Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the paper has been successfully implemented. Thus the paper has been successfully designed and tested. Thus the proposed system created bill of the purchased items. This process saved the time of customer and also reduced the manpower in the malls. So ultimately it becomes a easiest way of the shopping. Also with this system we have implemented the reward point system using Android application. The objective behind the application is to replace the existing card based system by android application. So the intended objective is successfully achieved in given system.

A secure smart shopping system utilizing RFID technology is employed in enhancing shopping experiences and security issues. The smart shelves are able to monitor the items on the shelves by reading the RFID signals from the tags. The smart carts are able to read and retrieve information of the items inside the carts and finally, the checkout points can validate the purchase made by a customer.

References

1. F. Xia, L. T. Yang, L. Wang, and A. Vinel, “Internet of things,” International Journal of Communication Systems, vol. 25, no. 9, p. 1101, 2012.
2. P. Castillejo, J.-F. Martinez, J. Rodriguez-Molina, and A. Cuerva, “Integration of wearable devices in a wireless sensor network for an e-health application,” IEEE Wireless Communications, vol. 20, no. 4, pp. 38–49, 2013.
3. N. Mitton, S. Papavassiliou, A. Puliafito, and K. S. Trivedi, “Combining cloud and sensors in a smart city environment,” EURASIP journal on Wireless Communications and Networking, vol. 2012, no. 1, p. 1, 2012.
4. T. Song, R. Li, X. Xing, J. Yu, and X. Cheng, “A privacy preserving communication protocol for iot applications in smart homes,” in to appear in International Conference on Identification, Information and Knowledge in the Internet of Things (IIKI) 2016, 2016.
5. S. Shepard, RFID: radio frequency identification. McGraw Hill Professional, 2005.
6. D. M. Dobkin, The rf in RFID: uhf RFID in practice. Newnes, 2012.D. Klabjan and J. Pei, “In-store one-to-one marketing,” Journal of Retailinand Consumer Services, vol. 18, no. 1, pp. 64–73, 2011.