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DESIGN AND IMPLEMENTATION OF AN AUTOMATED BILLING TROLLEY

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***Abstract*:**

A shopping center or complex is where individuals purchase item/s for their standard use. The clients need to stand by in long lines to get their items filtered utilizing scanner tag scanner and get it charged. To dispose of this, we have proposed a new 'Shrewd Shopping Streetcar utilizing RFID (Radio Frequency Identification)'. This execution is utilized to help an individual while shopping and furthermore to abstain from remaining in long lines and subsequently saving time. The savvy shopping streetcar would comprise of a microcontroller, Android Device, RFID Reader and an Electronic Display. The items in the retail outlets will have RFID labels to recover/access data about it. At the point when a client puts an item in the shrewd streetcar, the RFID Reader will peruse the Product ID and the data related to it will be put away in regulator. There will be correspondence between android gadget, primary server and charging framework (entryway framework) by means of ZigBee module. The aggregate sum of the items in the streetcar will be determined utilizing android gadget and will be refreshed on server and the Central charging System.

Keywords: RFID reader, Zigbee, RFID scanner, LCD display, smart cart.

INTRODUCTION

Technology plays a really important role within the constitution of attribute and identity. Humans have shaped and extended themselves by virtue of technical tools and artifacts [4]. The dynamic growth and the advent of new and exciting development in the field of IoT (Internet of Things) have paved the way for unique ways of using technology in a lot of fields. Wireless communication combined with radio and frequency sensing gives a whole new dimension to the way people interact with devices and use them in their daily routine.

Mankind always invented things according to their needs. As time passed human being became more demanding. In olden days there used to be some shops but as time passed by, some businessman started investing their money in market; they started the business of selling and buying the products. Hence the concept of mall came into pictures and in 1970's barcode technology came into existence. All such advancements need to be made to make the existing system faster and efficient with the help of barcode technology also the industrial work has been reduced. When products are moved from one place to other place the barcode technology helps to take inventory management in better way. After successful use of barcode, company started using barcode on products as well because after using the barcode it became easy to maintain product information in database more effectively. In 21st century different types of malls and supermarkets came into existence where people went to buy products and also to carry those products in the mall was tedious hence the concept of trolley/cart was invented. Consumer used this cart to add products and checkout through casher.

The objective of this project is minimizing time consumption and human association as much as possible and to reduce costs associated with hiring employees for manual billing process in super markets. When a person scans the products, it adds the total amount and displays the payable amount. If the customer changes his/her mind and does not want any product they can remove that particular product by scanning it again. the main goal is to reduce the time constraint of customers in queue and save time in supermarkets and also this system avoids mall practice by producing a beep sound if the product is placed by without scanning it. So, by making use of this system the super market shopping system will become more secure and easier.

Since wireless technology has been introduced the word automated, which is trending. Shopping at shopping malls and purchasing different products for daily needs which has its own advantages and disadvantages, though the food items are available at the door steps through online. The advantage is that the best product of the interest can be selected, and the main disadvantage is standing in queue at the billing counter which is hectic and time consuming.

The aim here is to create a system that combines the convenience of RFID tags and wireless sensing with a simple and easy tracking system that allows customers to purchase products without the hassle of waiting in queues. The customer simply has to put a product in the trolley and let the reader scan the product for information. By fitting the trolley with a touch-enabled LCD that can display product information, it also gives us a feasible system of providing the customer with all the information like manufacturing date, expiry date, price, etc. [13].

LITERATURE SURVEY

Mr. Mani.A[1] "A Novel Low-Cost Intelligent Shopping Cart" [1] proposed to develop a low-cost intelligent shopping aid that assists the customer to search and select products and inform the customer on any special deals available on the products as they move around in the shopping complex. S. Sainath in "Aisle-level Scanning for Pervasive RFID-based Shopping Applications" proposed to develop a system that is able to scan dynamic and static products in the shopping space using RFID Reader antennas. Instead of conducting the RFID observations at the level of individual carts, aisle-level scanning is performed.

Yathisha L [2] in "Developing a Multitasking Shopping Trolley Based on RFID Technology" proposed to develop a product to assist a person in everyday shopping in terms of reduced time spent while purchasing. The main aim of proposed system is to provide a technology oriented, low cost, easily scalable, and rugged system for assisting shopping in person. Muhib A in "Smart Shopping Cart with Automatic billing System through RFID and ZigBee" [5] proposed to develop a shopping cart with a Product Identification Device (PID) which will contain a microcontroller, a LCD, an RFID reader, EEPROM, and ZigBee module. Purchasing product information will be read through a RFID reader on shopping cart, meanwhile product information will be stored into EEPROM attached to it and this EEPROM data will be send to Central Billing System through ZigBee module. The central billing system gets the cart information and EEPROM data, it accesses the product database and calculates the total amount of purchasing for that particular cart.

Yewatkar et al [3] proposed each product in the shop or a mall will have an RFID tag on it. Each cart will have an RFID reader and zigbee trans receiver implemented on it. There will be online payment procedure for billing. If the product is removed, it must get deleted from bill too. There must be an RFID reader at the exit door for anti-theft. Depending upon customer buying habits display offers or discount on screen. Display product Info, expiry date, and better alternative. So, by making use of this, the supermarket shopping system will become easier. It will also provide anti-thefts system for a supermarket. It will enable online transaction procedure for billing, and it will also give suggestions to the user for buying products, display offers.

Bangi et al [4] presented system has 2 section transmitter section and receiver section. The costumer enters into the shopping mall she or he picked up a trolley for purchasing product. If customer want to purchase. Any product he or she put the product in the trolley. Using RFID reader, as soon as the product falls in trolley the RFID tag which is present on each and every product, read by the RFID reader. The RFID reader is connected to the Arduino processors product is inserting in trolley, and then the name of product and cost of product is displayed on the Liquid Crystal Display (LCD) screen. As customer add one by one product in trolley the cost gets added to the total bill. If user wants to remove any product, she or he can easily remove any product from trolley, then LCD display the name of product and cost of product is removed from trolley after completion of shopping a key is pressed for indication of final billing of all products. Thus, final billing information of all products is transmitted to billing counter through Electronic Stability Control (ESP) module. ESP module is a wi fi module which transmit billing information to counter. customers pay a bill at billing counter and leave from the mall.

Yathisha et al [5] explains whenever the customer puts a product into trolley it will get scanned by RFID reader and product price and cost will be display on LCD display, like this the process goes on. They are using ZigBee transmitter which will be at trolley which is used to transfer data to main computer. At the main computer zigbee receiver will be placed which will receive data from transmitter. An RFID reader can access the information of the tag from a distance of around 300 feet, whereas barcode technology cannot be read from a distance of more than 15 feet. RFID technology also scores over barcode technology in terms of speed. RFID tags can be interpreted much faster than barcode tags.

Wani et al [6] proposed when the individual will put any of the product in the trolley, the product code will be stored in the database of the controller, and then the bill that is, the name of the item and the cost of the product will be displayed on the LCD which uses a RFID reader all the products are equipped with the RFID tags. So, at the billing counter, the total bill data will be displayed on Personal Computer (PC) which will be transferred by the RF trans-receiver. And also, the bill is sent to the mobile phone through the bluetooth module. And also, they have added one billing method which is by the swiping the card.

Dhadge et al [7] proposed that the arisen the bascart framework. To build the speed of a charging cycle, RFID labels in items, then, at that point, the item is perused by the standardized tag scanner which depicts the expense of that item and is shows on the LCD screen connected in the shopping list. as client purchase their careful item its cost is add on the past list. the expense of the item is shown on the LCD screen by utilizing microcontroller through zigbee communication from have PC. zigbee upholds bidirectional correspondence among microcontroller and have PC. they have proposed the weighing sensor to actually look at the heaviness of the things and it is straightforwardly put away in the server data set.

vishnu et al [8] proposed system to keep away from this they are fostered a framework which is called as automation of shopping cart utilizing cell phone. In this framework they are utilizing RFID labels rather than standardized identifications. this RFID labels will be on the item. at whatever point the client places an item into streetcar it will get filtered by RFID per user and item cost and cost will be show on LCD show. like this the cycle continues. the streetcar follows us with next to no human effort. they are utilizing a GSM transmitter which will be at streetcar which is used to move the information to mobile. in smart trolley application, the sum will be sent, and the instalment will be finished utilizing portable.

Sahana et al [9] mentioned about the utilization of RFID innovation in the savvy shopping framework, as RFID detached labels have a more draw out range, from 1 to 5 m. Past research on the plan of savvy shopping frameworks essentially centered around utilizing low or high recurrence RFID, which have deficient ranges, and pass on clients to physically filter things with a RFID scanner. Here each savvy truck is furnished with a RFID per user, a miniature regulator, an LCD show, a wi fi module. every one of the information will be put away in the server. so, administrator can break down every one of the insights regarding items. zigbee is a remote correspondence innovation that gives multi hub correspondence.

Aher et al [10] provides an architecture in which blends Radio frequency identification (RFID) and wireless technology to provide on spot billing in supermarkets. It uses the RFID based system application in the shopping trolley and the RFID card which is used as a security access for the product. The LCD that is fixed to the trolley displays the product name, cost and the total cost of all purchased products. The bill is transmitted to the server end through the wi fi technology. The software simulation is done using Proteus software and hardware is implemented using 8051 microcontrollers. This promotes quick shopping and immediate pay without any queuing process. It reduces labor efforts and increases efficiency by minimizing errors.

Rahul et al [11] provides an idea about secure transaction between two devices, which uses Near Field Communication (NFC) for secure transaction. The identification and communication technologies as well as their advances. RFID smart phones, real-time response, and automated checkout systems have been considered in devising an NFC equipped smart phone. Logical Link Control Protocols (LLCPS) provide better security to authenticate transaction between to device which uses Peer to Peer (P2P) protocol for communication. LLCPS protocol has been used as an envelope in order to establish communication between the smartphone and the NFC reader, a suite of authentication protocols that is Single Input Single Output (SISO) has been developed for secure processing of payment in a retail store.

Tripathy et al [12] proposed system sends the billing details to the customer by mail, which lessen the worries about losing the bill. The requirement is to stick the RFID labels to all the products in the store instead of barcode sticker. A comparison of RFID with barcode. Thus, RFID reader is being employed to scan the products for billing, to send the data online to store it in the transaction database for future reference for the shop-owner and for providing customers the electronic bill. Essence of this approach involves using the RFID system to keep the details of each product. Each label in the products is stored with its name, id, and price. The task of waiting in queues for scanning and billing the products is alleviated. The customer can check their buying details online. The shop owner can reduce the number of employees in the shop. The shop owner can attract quite many numbers of customers to the shop.

Vinayak et al [13] proposed system creates the transparency in public distribution system as the work becomes automatic. Every consumer is provided with a RFID card which is registered by the government authority. User ID verified with the database provided by the government authority which is stored in the microcontroller. Once verification is successful, consumer is asked for a select type of material and quantity required through push buttons and keypad respectively. Based on type of material chosen, the motor or solenoid valve is activated. The load cell or level indicator is checked for proper quantity. After collecting proper quantity material motor or solenoid is disabled. GSM module will send the information in form of Short Message Service (SMS) to the user as well as Public Distribution System (PDS) authority. Current stock in the ration shop is displayed using LCD.

METHODOLOGY

When a customer with the cart enters a shopping aisle, the cart is brought in range of the IR Receiver and the microcontroller checks for the aisle information code. The aisle information code is transmitted over the ZigBee wireless from the cart to the server. Based on the aisle number received the database is queried and relevant information is retrieved and transmitted to the cart via the ZigBee module. The received information is stored in the EEPROM present on the cart. This serves as a temporary database until the customer exits the particular aisle that he/she is in. The relevant products information is displayed on the display unit. Every product has an RFID tag which contains a Unique ID. These IDs are fed in the database assigned to the corresponding products.

If there needs to be a purchase done, then that product can be dropped in the cart where the RFID reader reads the tag. The information of the product is extracted and displayed on the LCD screen. At the same time billing information is also updated. Upon exit of the aisle, the aisle info is sent to the server along with details of purchase. Server then stores them in the database. These steps are repeated until the end of shopping button is pressed. Once the "Complete" button is pressed there is an option provided to end the shopping with the same products or to delete some of the products from the cart. This goes by the customer choice. At the end of shopping, the customer can straight away pay the bill and leave. Inventory status of the products is also updated at the end of shopping.

BLOCK DIAGRAM

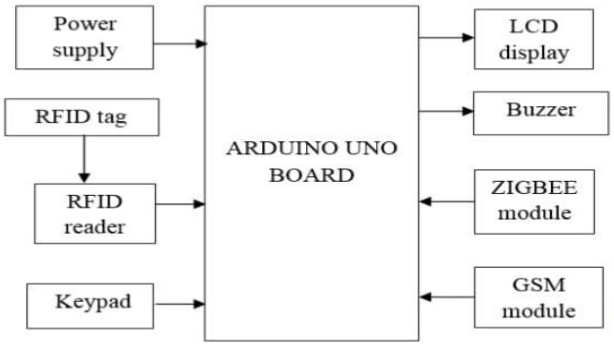

Fig 1.1 Block diagram of automatic billing trolley

This module has an inbuilt antenna that operates at a frequency of 125 kHz and a 5v DC power supply is required to power it up. RFID tag is embedded within each product. When the product is placed into a smart cart, the product detail is automatically read by the cart equipped with an RFID reader. RFID reader which is used to scan each product which has the RFID tag in it. LCDs are commonly used for portable electronic games, as viewfinders for digital cameras and camcorders, in video projection systems, for electronic billboards, as monitors for computers, and in flat-panel televisions.

Add and remove the product at the time of purchasing by seeing the budget which is already fixed using keypad. A buzzer is used to verify whether the membership card/product scanning is successful or not. Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. A GSM modem or GSM module is a hardware device that uses GSM mobile telephone technology to provide a data link to a remote network.

The Zigbee RF Modules was engineered to meet standards and support the unique needs of low-cost and, low-power wireless sensor networks. The modules requirement of minimal power and provide reliable delivery of data between devices. The modules functions within the ISM 2.4 GHz frequency band and are pin-for-pin compatible with each other.

HARDWARE UNITS

• Trolley Unit: In this unit the RFID reader and barcode reader are attached to ARM processor. when customer keeps any shopping item into shopping trolley this RFID reader reads the tag and sends a signal to the Processor. It gets stored in the processors memory which is compared with lookup table. If it matches, then it shows the name of item on LCD & also the total amount of items purchased.

• Billing Unit: With completion of shopping user comes near the billing counter. The total bill will display on the billing computer.

• Power Supply: The AC supply is applied to 12V step down transformer. The output of transformer is 12V AC which is rectified using a diode bridge. The output of Diode Bridge of 12VDC is filtered by capacitors.

• RFID Tags: RFID tags are mainly of two types, one without any battery called passive tags and another with the battery called active tags. We mainly use passive tags for our system for analyze the barcode's image data and sending the barcode's content to the output port of scanner. Multiple RFID tags can be read using a single RFID reader for a greater number of products which are added in the cart. Theft in the mall will be controlled using the smart system which further adds to the cost efficiency. The time efficiency will increase phenomenally since the system will eliminate the waiting queues. More customers can be served in same time thus benefiting the retailer and customers as well.

• IR Sensor: IR sensor is used for detecting a select light wavelength in the infra-red (IR) spectrum by using a specific light sensor. In IR sensor, LED is used that produces light at the same wavelength as what the sensor looking for.

• LCD Display LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. 16 Characters x 2 Lines Built-in HD44780 Equivalent LCD Controller Works directly with ATMEGA, ARDUINO, PIC and many other microcontroller/kits. 4 or8 bit data I/O interface Low power consumption.

• RF Module: RFID reader consists of an RF module that acts as a transmitter and receiver of radio frequency signal. Transmitter consists of an oscillator to create the carrier frequency; a modulator to make impact on data commands upon this carrier signal & a receiver that contains demodulator to extract the data returned. RFID Reader Module This is a low frequency (125Khz) RFID reader with serial output with a range of 8-12cm. It is a compact unit with built in antenna and can be directly connected to the PC using RS232 protocol [10]

CONCLUSION

The intended objectives were successfully achieved in the prototype model developed. The developed model has easy access, is economical and showcases an intelligent and easy shopping experience to reduce time, energy of the consumers. There are a few challenges/drawbacks to be resolved to make the proposed system more robust, but there is also no doubt that with the RFID having a wide scope in supply chain management, the proposed model has the potential to improve and ease the basic retail experience to a great extent.

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