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Automated shopping trolley for billing system

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ABSTRACT

The modern technology has increased the standard of living for humans. There has been an emerging demand for quick and easy payment of bills in supermarkets. Every one of us craves for quality in everything we use in our daily lives. This project describes how to build an automated and time-saving system for the world of retail which will make shopping experience impetuous, customer friendly and secure. So, this has resulted in large crowds at shopping malls which have to lead to long lines at the billing counter because the cashier has to scan every product item and then enter it into the billing record. The prevailing billing system is a bit time-consuming. So, we thought of inventing a remedial electronic product to catch-up with this problem. We call it "Automated shopping trolley for billing system".

Keywords— Smart shopping trolley, Barcode scanner, Raspberry Pi, LCD display

1. INTRODUCTION

Commonly as in vogue of now, shopping has become an integral part of today's society. We can see a huge rush at the mall and supermarkets during weekends, holidays and sales. A major concern for the customer at the mall and supermarket occur when there is a long waiting queue at the billing counter. The customer tends to leave the queue rather than standing for hours at the billing counter this turns out to be a trouble for the mall and supermarket owner. So, the automated shopping trolley which comes together with a bar code scanner and a touch screen display is designed which would help the customer to pay for their goods in the mall and supermarket without being served by a sales associate. Every product in the supermarket will have a bar code the customer will pick the product scan the barcode with the help of barcode scanner attached to the shopping trolley. After scanning the barcode, the concept is designed into a smaller version of the automated self-checkout system on a shopping trolley with a user interface screen which allows customers to make payment for items scanned and placed in the trolley before leaving the

entrance of the store. This is to release pressure during peak hours. The Smart Trolley comes with all the traditional services including scanning an item to check for price and details, also there are other additional features that will be included in the design such as locating an item in the store by typing in the item's name in the search field on the user interface screen which will automatically show the item's location and also we can set the budget. The Smart Trolley is designed with security measures to prevent it being wheeled out from the store's premises and also to protect customer's card details as it is designed to accept only card payment for items bought in the store. The details and the price of the product will be displayed on the touch screen display along with the total bill of the items purchased. This system would also be beneficial for the customer with a certain budget limit and saves long waiting time at the billing counter.

2. LITERATURE SURVEY

Janhvi Iyer et al. [1] proposed a system where each and every product has an RFID tag instead of a barcode scanner. The smart trolley will contain RFID reader, LCD display and Zigbee transmitter. When a person put any product in a trolley it will scan the product and the cost and name of the product will be displayed. RFID (radio frequency identification) automatically identifies and track tags attached to the objects. All the products have to be connected with RFID tags. The tags are read in any orientation and accuracy of the reading is more. It reads many tags at a time and the precision is more. In the shopping, trolley items can be read without a necessity to maintain a clear line of sight.

Bhagyashree Bhumkar et al. [2] in this paper all the trolleys in the mall are attached with the device which contains RFID reader, Microcontroller, Zigbee. So each trolley will send the item information to the main billing server for calculating the final bill of the purchased items. The customer puts the items into trolley here items are with RFID tag so when the customer selects the item and put an item into the

trolley, the RFID reader reads the data, the data is nothing but the tag number. The only change in this paper is that it is an android application where the customer has to register.

P. Chandrasekar et al. [3] the authors have presented their idea in which each commodity in a mall will be attached with an RFID tag and each trolley will be attached with an RFID reader which would be working on the ZigBee wireless module. A centralized system is present for any help and queries and for the billing transaction of the products by the customers. Even the exit gates of the mall are laced up with the RFID readers for detecting any theft. However, there is no user interface and hence it is not a user-friendly system.

Vrinda et al.[4] have featured a cart equipped with an RFID reader, a ZigBee transceiver and an LCD display. This smart shopping cart keeps an account of the bill made by keeping running total of the purchases. An LCD screen shows the total bill of the items present in the cart. However, this system does not have a user interface and ZigBee is used instead of a Wi-Fi module. This work, however, lacks built-in security checks for discrepancies.

Ankush Yewatkar et al. [5] proposed Smart Cart with Automatic Billing, Product Information, Product recommendation Using RFID & Zigbee with Anti- Theft system This smart shopping cart system keeps the track of all purchased products using RFID & Zigbee. For final billing, online transactions are recommended. The system also gives suggestions to the shopper with the help of the centralized system about offers/discounts based on the purchase history of a shopper with the help of a centralized system. One of the important feature this system introduced for anti-theft by attaching an RFID reader at the exit door.

Dhavale Shraddha et al. [6] proposed IOT based intelligent trolley for a shopping mall with RFID technology for billing during the purchase in shopping malls and IOT is used for bill management by means of ESP module. The payment details will be sent to the server by which the central billing unit will deal with the customer's payment. The ESP module will be working as a short distance Wi-Fi chip for wireless communication. But there is a drawback which includes constraints such as distance and interference. The server will be busy if customers are high and internet connectivity should be stable for finishing the process.

Sainath et al. [7] proposed the automated shopping trolley for a supermarket billing system with barcode for billing of products, where customer scans the product using barcode technology. The bill will be forwarded to the central billing system where the customer will pay them by showing a unique id. The limitation of barcode scanning requires line of sight for scanning and it should be fixed within its boundary.

Budic et al. [8] proposed a system of Cash register lines optimization system using RFID technology and developed a system for shopping using RFID. The RFID is employed for scanning products and the information is stored in the database which could be paid online or in a central bill. It also uses web application to maintain entire shopping details. It requires maintenance of a web application server. No necessary steps have been taken for the products that are accidentally dropped into the trolley by the customer.

Jadhav Rahul Shankar et al. [9] proposed RFID based Automatic Billing Trolley technology. In automated billing technology, each shopping trolley is attached with RFID reader

& LCD display and every each product is RFID attached with an RFID tag to provide a better solution to the manual billing method in a shopping mall.

Raju Kumar et al. [10] proposed an Intelligent Shopping Cart system. It consists of three modules- Server Communication Component for connection of the shopping cart with the main server, User Interface and Display Component to provide the user interface, and Automatic Billing Component handles billing section.

Udita Gangwal et al. [11] proposed a Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks. This system used WSN combined with a highly reliable Image Processing technique to automate the entire billing process and to reduce the entire communication requires only one Passive sensor (load-cell) is used.

G.S.Rajagopal et al. [12] proposed a Smart Intelligent System for Shopping and Billing. In this paper smart shopping cart equipped with RFID tags is considered, to verify the purchase details. Centralized billing system to automatically bill the shopper for the purchases.

Anjali Verma et al. [13] proposed RFID based Smart Multitasking Shopping Trolley System. The proposed system evaluates many strategies to assist shopper to minimize the overall shopping time required in the mall. This system also provides real-time updates based on the inventory to the store management.

Mohit Kumar et al. [14] proposed a Smart Trolley with Instant Billing to Ease Queues at Shopping Malls using ARM7 LPC2148: A review. It is smart & faster-embedded billing system by interfacing RFID and ZIGBEE module with the microcontroller.

Mr.Yathisha L et al. [15] proposed "Automation of Shopping Cart To Ease Queue in Malls By Using RFID". In the proposed system RFID tags are used instead of barcode readers to scan product price and that is displayed on the LCD. For communication Zigbee transmitter & receiver is used at trolley & central computer respectively.

3. PROPOSED SYSTEM

This Automated shopping trolley makes note of all the scanned commodities of the particular trolley with allotment number and is linked with the supermarket's backend database which contains details of the product such as cost price, available stock, the quantity of the product and location of the product. The automated shopping trolley system is linked with various devices such as barcode scanner, Raspberry Pi, LCD display, loadcell, buzzer, switch module, database.

It provides the facility to the customer to self-scan the products which the customer wants to purchase. After purchasing or self-scanning the product if the customer wants to make changes in product detail such as add or remove he can easily update the products detail by using the touch screen where the add, remove, update, delete keys are provided. A wireless smart device makes note of all the scan products of the particular trolley and is linked with the supermarket backend database which contains detail of the products such as price, stock. As we have provided the self-scan facility to the user and the wireless smart devices which make of all the scanned products and connected with supermarket database. At the time of purchasing the products, the customer is aware of the total bill.

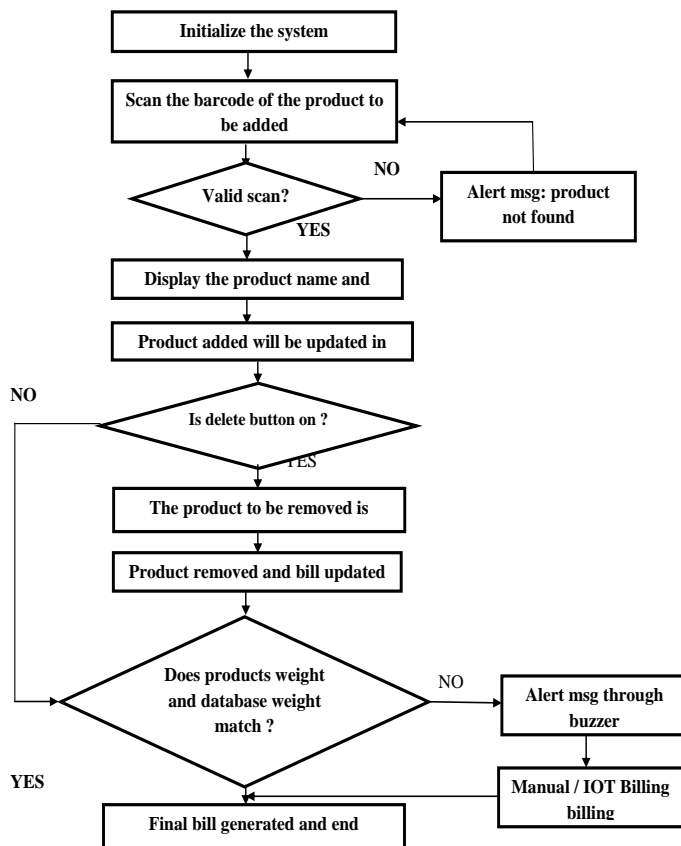


Fig. 1. Flow chart

3.1 Raspberry Pi

The Raspberry Pi is a series of small single-board computers. The Raspberry Pi is designed to be connected to the Internet. The connection can be wired through an Ethernet cable, or the Pi can use a USB Wi-Fi module to provide a network connection. The Raspberry Pi 3 features the same 40 pin - output (GPIO). It promotes Python as the main programming language. Raspbian is the Operating System. Raspbian is a version of Linux built specifically for the Raspberry Pi. The Raspberry Pi 3 Model B is the third generation Raspberry Pi. Raspberry Pi 3 Model B brings a more powerful processor, 10x faster than the first generation Raspberry Pi. Additionally, it adds wireless LAN and Bluetooth connectivity making it the ideal solution for powerful connected designs. Peripherals and GPIO, the Raspberry Pi 3 has general purpose IO pins, 4PWM capable pin and several buses (SPI, I2C and UART). It does not have analogue input at output pins.

3.2 Load cell

A load cell is a transducer which is used to create an electrical signal whose magnitude is directly proportional to the force being measured. The load cell is the heart of any weighing machine or electric scales. This type of transducer is highly accurate which provides the user with the required information. Strain gauge load cells work on the principle that the strain gauge (a planar resistor) deforms when the material of the load cells deforms appropriately. Deformation of the strain gauge changes its electrical resistance, by an amount that is proportional to the strain. The change in resistance of the strain gauge provides an electrical value change that is calibrated to the load placed on the load cell.

3.3 Barcode reader with camera

A barcode reader is an electronic device that can read and output printed barcodes to a computer. It consists of a light source, a lens and a light sensor translating optical impulses into electrical ones. Additionally, nearly all barcode readers

contain decoder circuitry analysing the barcode's image data provided by the sensor and sending the barcode's content to the scanner's output port. A standard barcode scanner shines LED or laser light across a barcode, and the beam is reflected back into a light detecting photoelectric cell. The resulting pattern of impulses corresponding to the black and white stripes is converted into respective decimal numbers. After acquiring an image, a digital camera sends it to the software. Here, a program pre-processes the image to prepare it for further analysis. This stage usually includes converting to grayscale and applying various filters to reduce image noise and enhance barcode edges. After that, a binary operation is performed, which means that only black and white pixels remain in the image. The decoding process consists of two major steps: the location and decoding of the barcode as such.

3.4 Switch module

A toggle switch is a class of electrical switches that are manually actuated by a mechanical lever, handle, or rocking mechanism. The phrase "toggle switch" is applied to a switch with a short handle and a positive snap-action, whether it actually contains a toggle mechanism or not. When the actuator-the toggle itself-is moved, the armature in the switch moves the moveable contact into position either energizing the circuit or de-energizing it.

Adding products: The corresponding toggle switch is put to ON state before adding products into the trolley, it also activates the barcode scanner with camera module which scans the barcode on the product held in front of it and displays the corresponding weight and price of the product on the LCD.

Billing: Soon after the customer finishes shopping, they can immediately turn OFF the toggle switch corresponding to the "adding products" and turn ON the billing switch which immediately sends an e-mail to the main server at the billing counter

Removing products: when the customer wants to remove a product from the trolley and place it back in the rack, it can be accomplished before turning ON the billing switch by toggling the switch, first to ON and then to OFF state, provided for removing products and then scanning the barcode corresponding to the product to be removed.

3.5 LCD

Liquid Crystal Display is a very important device in an embedded system. It offers high flexibility to user as he can display the required data on it. LCD driver is a link between the microcontroller and LCD. we set the interface mode, display mode, address counter increment direction, set contrast of LCD, horizontal or vertical addressing mode, colour format. Next step after initialization is to send data bytes to required display data RAM memory location. Firstly, set the address location using address set command byte and then send data bytes using the DDRAM write command. 14-pin access is provided having 8data lines, 3 control lines and 3 power lines. The connections are laid out of in one of two common configurations, either two rows of seven pins, or a single row of 14-pins.

3.6 HX711 Weighing Module

HX711 load cell amplifier module uses 24 high-precision A/D converter chip hx711, is designed for high-precision electronic scale and design, with two analog input channels, the internal programmable gain amplify integrated multiplier 128. The HX711 uses a two-wire interface (clock and data) for communication. The input circuit can be configured to provide

a bridge type pressure bridge (such as pressure, weighing sensor mode) which is of high precision.

3.7 Buzzer

A buzzer is an audio signalling device, which may be mechanical electro-mechanical, or piezoelectric (Piezo for short). Typical uses of buzzers and beepers include alarm devices, timers.

4. CONCLUSIONS

In this paper, the successful use of the Raspberry Pi system for the smart shopping trolley has been explained. The drawbacks addressed in previous shopping trolley applications which were overcome in this application. Project Implementation will help all people who are shopping in the supermarket and face the problem of standing in a long queue for final billing

The implementation is easy, very economical and will reduce the time required at the billing counter. In our project, we designed automated shopping trolley for the billing system, which can be used in any supermarket and by any person easily. The Smart Trolley was designed to function as a self-checkout system providing users with the flexibility to make transactions from it within the retail store. It is designed to be highly efficient and fully synchronized with the retailer's current system.

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