

# Automated Shopping Trolley for Billing System

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**Abstract**— As technology is developing day by day, shopping malls should be capable of handling the crowd smartly. Every shopping mall provides shopping trolley to the customers in order to select the product from the store and put that product in the trolley. Further, they have to move towards the billing counter for the billing purpose and customer have to wait in the long queue for his turn. The smart trolley which consists of a raspberry pi device, camera based barcode scanner, switch module and LCD will help the customer to save his time during the bill payment at the bill counter.

**Keywords:** Raspberry Pi, LCD, Switch Module, Camera Based Barcode Scanner

## I. INTRODUCTION

In today's era shopping involves some digitalised technologies to comfort the customers. In traditional, 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. Shopping can be done either in-person or by online. Even though in online shopping the time will be saved, but the customer cannot be able to analyse the quality of the product. Shopping in-person by visiting the shop, selecting the products, and finally standing in a queue for billing will take much time. The proposed system overcomes these problems and makes the shopping process faster and convenient. So we need to develop a project for automated shopping trolley with bar-code scanner which aims to reduce the total waiting time of customers, total man power requirement for markets in order to improve efficiency of shopping malls. In a world where technology is replacing the ways we pursue everyday activity, the future of retail industry also lies in more automated devices.

## II. RELATED WORK

Awati and Awati [3], describe a Smart Trolley design that mainly deals with how to get the customers rid of dragging heavy trolleys and to automate billing, but it assumes all the customers to be honest and hence does not tackle cases of deception, if there are any.

[1] In this paper the latency time of the wireless communication with the server may need to be considered. Secondly, a secure communication with server will be much more convenient. Another ZigBee module operating at the same frequency can easily intercept the transmitted data [2]. This issue will have to be resolved to promote consumer confidence.

Yew et al. [4] propose a smart shopping for future where the barcodes are completely replaced by Radio

Frequency Identification (RFID) tags and scanners. This idea might take a long time to be deployed as it is expensive both in terms of money and energy.

In the paper[5] the system uses wireless sensor network, which includes overhead in transmission. The effect of multiple users operating at the same time, as well as any spectrum coexistence issues must be studied since the proposed system uses the over-used 2.4 GHz spectrum.

Authors in [5] have proposed shopping assistants that help the customers in locating the products inside the store, if any product has any discounts on the move of the customers inside the shopping mall. However, the assistant serves the purpose of simply locating products and not billing them. Hence, the problem of time being wasted in long queues remains unaddressed.

Overall, the existing systems have the following limitations:

- 1) They offer a regular cart without any system integrated to it.
- 2) There is no display of product details on the cart.
- 3) A limit on the budget and alerting system is absent.
- 4) They allow for scanning of products only at the check-out counter with the help of barcode on the product.
- 5) They require that the barcode should be noticeable on the top of commodities. Otherwise the product will not be read. However, the legibility of barcodes can be hindered by soil, humidity, water, corrosion.
- 6) The employees or owner of the mart should manually check for demand or depreciation in stock of a particular product.
- 7) Manpower is required to guide the customers through the mart to find the product of the product required.
- 8) Payment is made only at the counter after waiting in long queues.

## III. PROPOSED SYSTEM

The aim of this project is to utilize updated new technologies and to suppress the difficulties during shopping in customer retail shop in order to avoid the long queue in billing section. This project proposes a system implementation of wireless technology using Raspberry Pi, LCD display, load cell for weighing and theft detection, Wi-Fi module which communicates between trolley and main computer for the purpose of billing, then the switch module to add or remove products, scan the product and finalize the bill. Hence, this system is automated such that the customer himself scans the product and puts it into the trolley and then, the Wi-Fi connected to the trolley sends the details of the products to the main computer at the counter where the bill is generate and copy of it is sent as mail to customer. Finally, the customer pays the bill at the counter and leaves the place without having to wait for more time.

#### IV. BLOCK DIAGRAM

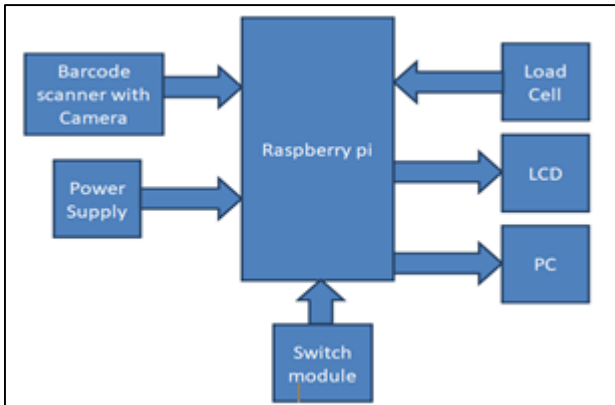


Fig. 1: Block diagram of the system

#### V. FLOWCHART

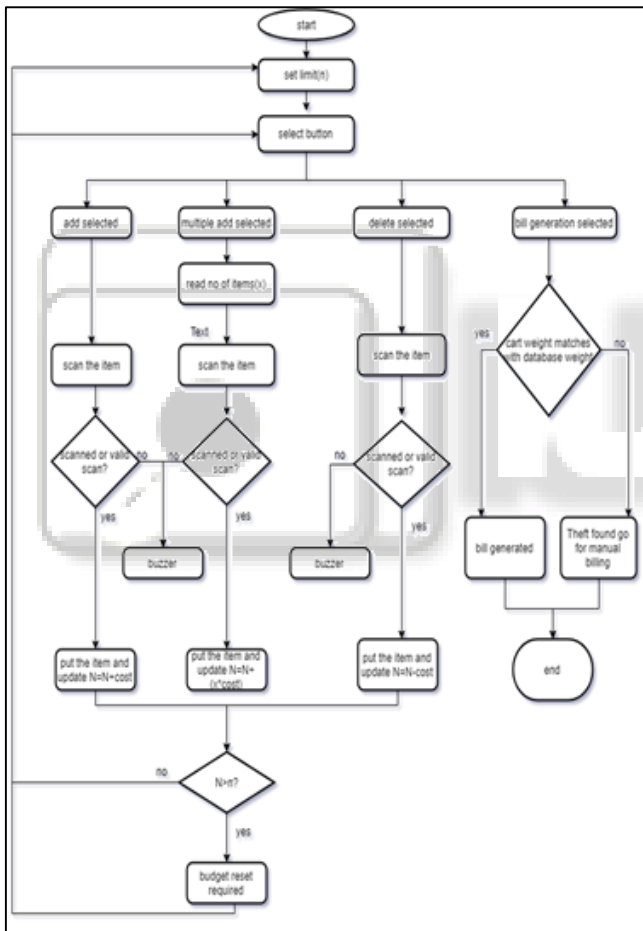


Fig. 2: Process Flow of the system

#### VI. IMPLEMENTATION

A prototype has been made based on idea of using camera based barcode scanner for every Trolley, in order to make the system cost-effective. The various components that are used in the implementation along with the important considerations are explained in details.

#### A. Raspberry Pi

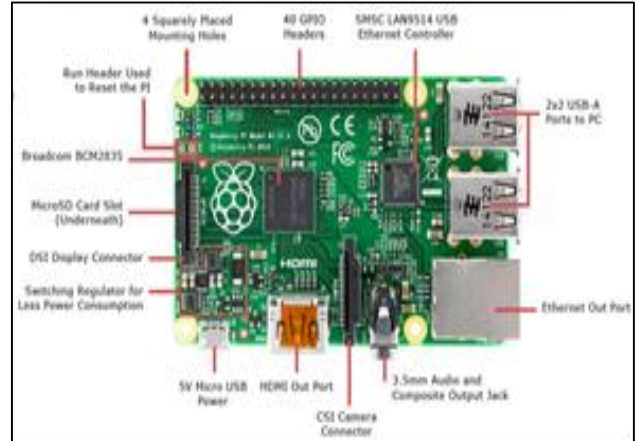


Fig. 3: Details of Raspberry pi

The Raspberry Pi is a computer, and from a connections point of view it doesn't look much different to a normal desktop computer. It has USB ports for connecting a keyboard and mouse, and a video output port for connecting up a display.

The Raspberry Pi is meant to be connected to the net. The connection can be wired through an Ethernet cable, or Pi can use a USB WI-Fi module to provide a network connection. The Raspberry Pi 3 features the same 40 pin general-purpose input-output (GPIO) header as all the Pi is going back to the model B+ and model A+. Python is its main programming language. Raspbian is a version of UNIX engineered specifically for the Raspberry Pi.

#### B. Load Cell



Fig. 4: Load cell

Load cell is a electric device that converts force into a measurable electrical output. The load cell is the heart of any weighing machine or electric scales. It is mainly required for the theft detection in the system at the time of billing.

#### C. Barcode Reader with Camera



Fig. 5: Camera

A barcode reader is a device that will read and output printed barcodes to a computer.

It consists of a light-weight source, a lens and a light-weight sensor translating optical impulses into electrical ones. Additionally, nearly all barcode readers contain decoder electronic equipment analyzing the barcode's image information provided by the sensor and sending the barcode's content to the scanner's output port.



Fig. 6: The user interface of the barcode scanner showing the detection and non-detection of barcode

A webcam is supposed to be fixed at the top, facing the slab attached to the cart. The ZBar barcode reader is used, which supports many popular types of barcodes. The figure shows the two conditions.

#### D. LCD

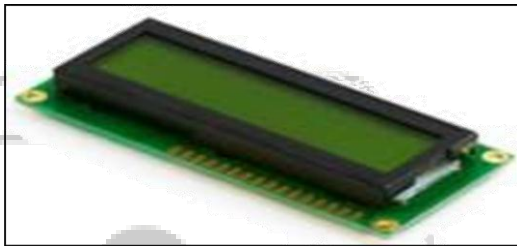


Fig. 7: 16X2 LCD display

Liquid Crystal Display is a very important device in an embedded system. It offers high flexibility to the user as he will show the desired information thereon. Firstly, set the address location using the address set command computer memory unit so send data bytes using the DDRAM write command. 14-pin access is provided having 8 data lines, 3 control lines, and 3 power lines. The connections are laid out in one of two common configurations, either two rows of seven pins, or a single row of 14-pins.

#### E. HX711

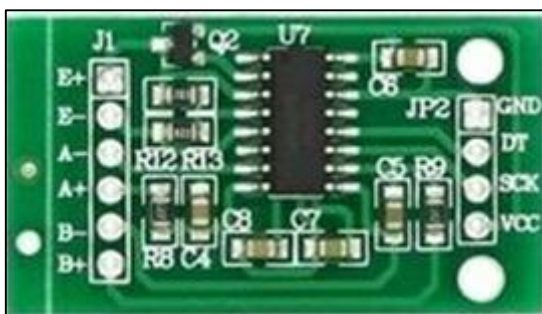


Fig. 8: HX711 weighing sensor

The changes in electrical resistance provided by the Load Cell need to be amplified so that they can be read by an Arduino. That's exactly what the HX711 board does. It reads the information from the Load Cell, amplifies the signals and then sends it to the Arduino for processing.

#### F. 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 embody alarm devices, timers.

#### G. Power Supply

In most of our electronic projects need a regulated DC voltage. For making a power provide each and every component is important. The blocks for designing a power supply are a transformer, bridge rectifier, filter, and regulator. Here we are designing twin power provide one amongst 5V and one amongst 12V. Here we use a step-down transformer that converts 230V 50Hz to a required small voltage. The bridge rectifier converts the transformer output to a pulsating DC. Filter went to convert the beating DC into the ripple DC. Regulator finally converts ripple DC into pure DC.

#### H. Switch module

A toggle switch is a category of electrical switches that are manually operated 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 truly contains a toggle mechanism or not.

When the actuator-the toggle itself-is moved, the coil within the switch moves the movable contact into position either energizing the circuit or de-energizing it.

##### 1) Adding Products:

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

##### 2) 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

##### 3) 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.

## VII. RESULTS AND TEST CASES

- When there are products with discount, those products are scanned and the price will be discounted and displayed on the LCD.
- After the all the products are scanned, if a product has to be removed the customer switches on the delete button and scan the product to be removed before billing.
- Initially if the first product is put into the trolley without scanning, there will be a buzzer to indicate theft. Once the product which is not scanned is removed from the trolley then the buzzer goes off.



- All the products are scanned and put into the trolley, if there is a product which is not scanned and put in the trolley and then tried to bill, then there will be a buzzer.
- When the customer scans a product, but forgets to keep it in the cart, there will be a weight mismatch and he will be prompted to put the scanned item in the cart.
- When the customer attempts to scan one product, but place multiple products in the cart, the buzzer sets on and the discrepancy can be handled.
- If the customer tries to take away one product of higher price by scanning the barcode of another product of lesser price. There will be mismatch in weight and bill cannot be generated.
- If the customer exceeds his budget limit, and still wants to continue shopping, "the budget reset" option is available to continue his shopping.

#### VIII. ADVANTAGES AND DISADVANTAGES

##### A. Advantages

- Smart Trolley System reduces time spent at billing counter and increases customer satisfaction.
- Smart Trolley System reduces manpower required in billing section. This can reduce the expenses incurred by the management.
- Smart Trolley System can detect any kind of discrepancies such as theft.
- If there is offer on a particular product our system automatically discounts from the actual price and display the final price of that product.
- The budget limit can be set by the customer before he actually starts shopping, if the budget and he still wants to shop, budget reset option is also available in the proposed system.

##### B. Disadvantages

- Smart Trolley System requires constant power supply.
- It gives the correct result for all the cases except for the case when the lighting condition is very poor, i.e., when the lighting condition in the environment is very dim/dark.

#### IX. FUTURE SCOPE

The proposed system is not using any routing algorithm to find the location of item. This can be further improved to reduce time required in locating the desired product with ease. The customer just needs to type the name of the product he wants to search on the android device, and the cart will automatically guide him/her to the product/s locations.

#### X. CONCLUSION

The smart shopping trolley application creates an automated central billing system (ACBS) for supermarkets and malls. Using PID (product identification), customers will not have to wait near cash counters for their bill payment. Since their purchased product information is transferred to the base station for billing. Customers can pay their bill through credit/debit cards as well. The system proposed is highly dependable, authentic, trustworthy and time-effective.

It is helpful for the customers who shop with the budget limit.

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