Intelligent and Innovative Shopping Cart for Smart Cities Using Internet of Things (IOT)

Dr. Suresh M.B[1], Poorvika N[2], Rakshith B M[3], Sripriya K[4], Sushma P Nagesh[5]
[1]*Head of the Department, Department of Information Science and Engineering, East West Institution of Technology, Visvesvaraya Technological University, Karnataka*
[2345]*Student, Department of Information Science and Engineering, East West Institution of Technology, Visvesvaraya Technological University, Karnataka*

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. With the development of wireless technology there are various fields wherein we can use this technology and use of wireless technology is favorable now a days. In this paper we present our views on an automated shopping trolley using raspberry pi device combined with camera and a digital display panel. As we know that during sales and holidays, we observe rush at supermarkets and due to this billing process becomes more time consuming and customer cannot stand for too long in a queue for billing purpose so, here we can make use of the automated shopping trolley which has a camera, raspberry pi, mass detection and digital display panel. Web application for online processing and cash payment is developed. Using this trolley, the customer will self-scan the product by himself and prepare the bill. Hence, there will be no long queue in the supermarket at billing counter for billing purpose.**

Index Terms **- automated shopping trolley, Raspberry pie, camera, digital display panel, mass detection, web application.**

I.INTRODUCTION

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. With the increasing reliability and cost effectiveness of—Internet of Things (IoT) based connected smart things in the field of consumer applications, it makes better sense to ensure such technologies are put to use in addressing the day-to-day concerns of the common man. In this framework, we portray the execution of a dependable, reasonable and cost-effective Smart Shopping Cart. Such a framework is reasonable for use in any Walmart and shopping spots, for example, general stores, where it can help in diminishing work and in making a superior shopping background for its clients. Rather than influencing the clients to sit tight in a long line for looking at their shopped things, the framework helps in mechanizing the charging procedure. Alongside this capacity, the framework configuration additionally guarantees identification of instances of duplicity conjured by deceptive clients, which influences the savvy framework to reasonable and alluring to both the purchasers and merchants. The framework outline alongside the execution is exhibited here. The outcomes are empowering and make shopping less demanding and helpful to the clients. The fundamental target of the proposed framework is to give an innovation arranged, keen, ease, adaptable and rough framework for a superior in-shop involvement for the cutting-edge world client. With the increasing needs of humankind there is the need for development of new technology to make day to day work easy and effortless. In this project, we are going to develop an interactive smart trolley system by using Raspberry Pie. This system not only allow user to use the real-time spending feedback with budget detection system on the trolley but also manage to interact it with the web application. Before using the smart trolley system for shopping, user can create their shopping list on the web application. Then, during using the smart trolley system, user require entering their account in order to synchronize their shopping

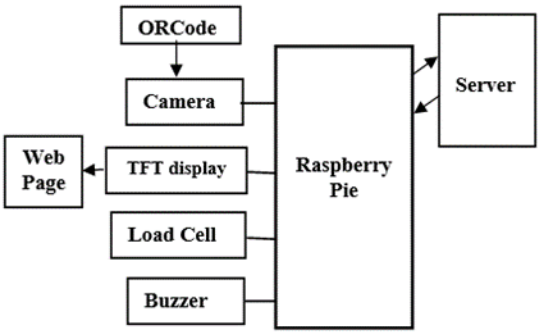
lists. This idea of the system provides a simple and interactive way for user during shopping for groceries. By using this system, they would not miss out what they plan to buy and under their budget amount. The customer himself will add a product and bill himself without the need for any other human resources from the shopkeeper side. The proposed system provides solution to improve the speed of purchasing of products and faster payment option. This system provides solution to improve the speed of purchasing of products and faster payment option. In this solution we are using Raspberry Pi, QRcode scanner, digital display panel and a button were placed appropriately in the shopping cart. Automatic billing generates the bill once the shopping is completed. Therefore, the main aim of the smart shopping cart is to reduce the shopping time. The customers themselves can make billing, so it is easy for the customer to estimate the bill also. The shopping malls can reduce the manpower at billing counters and space occupation which in turn reduces efforts and investment. These efforts and investment can be used to improve the quality and consumer experience. More products can be placed instead of billing counters to attract customers. The shopping mall owners also reduce the economy on the billing counters. More products can be placed instead of billing counters to attract customers.

II. LITERATURE SURVEY

Related work presents the different techniques proposed by the researchers related to IOT based shopping cart. In paper [1] author has discussed the current problem of waiting in a long queue during billing process and there is a huge amount of rush at the time of festival to avoid this problem author proposed smart shopping cart. It consists of LCD, barcode technique, microprocessor, and Bluetooth. Barcode is used to scan the items which are purchased by the customer and it will store it in the database Microprocessor is used to calculate the total price for all purchased items and display on LCD, the total bill is sent to the owner using Bluetooth and generates the sales slip. It saves the customer time with less effort. In [2], the authors succeeded in implementing a low budget, smart and fully functional system to make the experience of shopping convenient and comfortable for customers. They made use of RFID technology because of its efficient tracking capabilities and security features. The system deployed features like setting a budget, product addition, and removal, recommendation, as well as addition and deduction of the cost of the product depending upon its presence in the cart. In paper [3], the authors created a concept model which made use of RFID tags fitted on the products as well as ZigBee to transmit bills to a central server. The drawback here is again, the lack of alternative options for payment of bill as opposed to the traditional counter payments. The worker is supposed to collect the bill once the customer is identified, which leads to the customer waiting in queues. In paper [4] author discussed the current problem of shopping mall for buying the items, which requires a trolley. A customer has to check those items and need to compare with his pocket money. So, to avoid this problem author proposed smart trolley in a mega-mall. It is microcontroller based automatic trolley and it chases the customer while, he is buying the items and it will maintain distance little bit away from the customer. A customer has to place the products which are in front of the color sensor which detects the color wrapper of the product and it will display the product name and cost on LCD. We have reviewed different papers on smart shopping systems. From the above papers we conclude that, here in these papers they have used concept of RFID tags and RFID reader to scan the products and get the bill of total number of items purchased. But the RFID systems are more expensive than ORCode system and it can be less reliable. To overcome this drawback, we have used the concept of automated shopping trolley using raspberry pi and a camera with LCD display, it consists ORCode instead of RFID tags. The customer will scan the QRCode instead of RFID tags. Also, with the use of QRCode we do not need to attach separate tags to the products, barcode is printed on the product itself. And one more thing the proposed a system in which RFID tags are attached with products and that tags are read by the RFID reader. But in this system, it may happen that more than one RFID tag can respond at the same time. Also, RFID tags are usually larger than QRCode. To overcome this drawback, we use QRCode and a Camera to scan which is more efficient.

III. BLOCK DIAGRAM

Figure 1: Block Diagram



IV. PROPOSED SYSTEM

The fundamental goal of this paper is to diminish and kill time taken in charging counter in grocery stores by outlining a smart Shopping Trolley for Shopping Centre Utilizing Web Application which utilizes standardized tags to allow clients to self-checkout and increment efficiency time. The basic purpose of innovation in technology, irrespective of the domain, has been in simplifying everyday chores and making it easier, faster and efficient. One trivial task, that human beings spend considerable amount of time, is in shopping. However, the shopping carts are the same, serving simple purposes since they were first manufactured, not undergoing any changes either to design or their purpose. This motivated we to build an innovative shopping cart that not only make the shopping efficient but also enjoyable and convenient to the customers. Every Shopping Cart is equipped with a camera, a weight sensor, a small computer for local processing and a digital display panel. The Base Station at a centralized location consists of a database that stores information of all the products, and can communicate with all the Smart Carts via the Wi-Fi network. When a customer starts shopping, she/he has to login with a Customer ID and link the Cart ID with the Customer ID, once registered; they can scan the products one by one with the Camera using QRCode present on each product and keep adding them to the cart. They get the list of products available in shop and present on going offers on the digital display. In order to handle all the cases of mistake/dishonesty, the design includes the use of weight sensor at the cart. In addition, we can set the budget before starting the shopping. Budget setting helps to set the budget if purchase cost reaches the budget value a buzzer buzzes. Once the customer finishes shopping, she/he then proceeds to the payment counter to pay the bill amount. In addition, the supermarket management will be able to analyses the shopping behaviors of various customers to arrive at valuable business insights. These will be very beneficial for the retail stores. Overall, this system will ensure that the customers will enjoy the shopping experience and come more often to shop.

V. ADVANTAGES

- Less Manpower, reduces manpower required in billing section. This can minimize the expenses incurred by the management.
- User Know about extra expenses, Clients can know about the aggregate bill amid the time of buy.
- Less time consuming: Reduces time spent at billing counter and improves.
- Enhance shopping experience of customers in supermarkets.
- Alert users when exceeding the estimated budget.

VI. DISADVANTAGES

- Becomes a repetitive procedure by reading each and every product's barcode by biller for each customer.
- The Barcode should be free of any impairments, such as dirt, dust, abrasion or contours of packaging.
- In case if the barcode is not checked the biller will enter the description of the product manually.

VII. MODULES OF THE PROJECT

Login Page: User have to first login through login page. If the user is already a member of the shopping mall app it asks login details to login.

Sign-Up Page: If the user is new then the system asks for the registration details of the user. The Registration details constitute of name, email ID, phone number, password setting etc.

Main Window: After login shopping mall app details page is displayed. It consists of Product list, Budget setting, Cart, Payment.

Product List: In Product list it contains stock and out of stock of the products in the shopping mall.

Budget setting: Budget setting helps to set the budget if purchase cost reaches the budget value a buzzer buzzes. We can set our budget before starting the shopping.

Cart: Scanning the QRCode, product name and cost compare with data, which is already stored in Pic microcontroller and it is displayed on the Cart screen. Here we can add, remove the products and parallelly the total bill and budget cost will be displayed on the screen.

Payment: Once customer finish off purchasing products then customer has payment option, where customer can pay bill through two options, card or any online payments.

Successful payment: After completion of shopping, customer fills the payment details online. Once the payment is done, it shows the "payment successfully done!".

VIII. USE CASE DIAGRAM

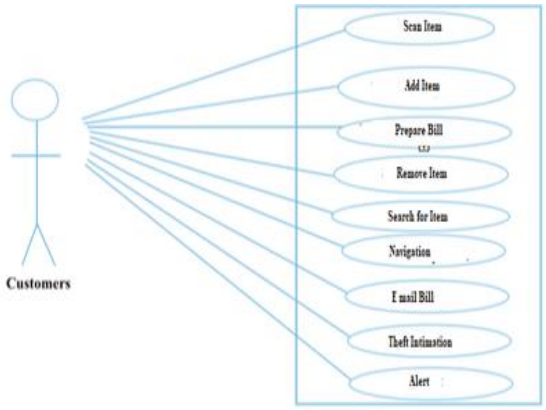


Figure 2: Use-case Diagram

IX. IMPLEMENTATION PLATFORM

We are employing both hardware and software to accomplish this solution. The following are the tools that were employed to put this concept into action.

Hardware Requirements:

- Raspberry Pi
- Load Cell
- Power Supply
- Camera
- Buzzer
- Digital display panel

Software Requirements:

- Open cv
- Python
- Linux

Raspberry Pi 3Model B Raspberry Pi 3 The Raspberry Pi 3 is the project's main component. Raspberry Pi is a credit-card-sized computer that may be used to make smart devices or utilized as a desktop computer. The Raspberry Pi was designed to be a microcomputer that could be used to educate youngsters how to code. After enthusiasts and engineers discovered its potential, it was enlarged, and it is today one of the most popular technological goods on the planet. Basic programming was supposed to be possible with these small computers. Pi was predicted to be simple to operate due to its low power consumption and inexpensive cost.-Quad Core 1.2GHz Broadcom BCM2837 64bit CPU supported by 1GB RAM on board, BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board, 40-pin GPIO, 4 USB 2 size HDMI ports, 4 Pole stereo output and composite video port, Full CSI camera port for connecting a Raspberry Pi camera, DSI display port for connecting a Raspberry Pi touchscreen display, Micro SD card slot Switched Micro USB power supply has been upgraded to 2.5A.

Load cell a force transducer is a load cell. It turns a force like tension, compression, pressure, or torque into a measurable and standardized electrical output. The electrical signal varies proportionately to the force applied to the load cell. The weights of the scanned goods are verified using the Load Cell in this project.

Power Supply Electricity A micro-usb plug power supply capable of delivering at least 1A is utilized. It is also powered by a battery.

A Camera reader A camera reader is an electrical device that reads images from a camera and prints them to a computer. It is made up of a light source, a lens, and a light sensor that converts optical to electrical impulses. Furthermore, all Camera readers have decoder circuitry that analyses the picture data produced by the sensor and sends the content of the camera to the scanner's output port.

Buzzer In this project, a buzzer is a beeper gadget that is used for alert reasons.

Digital-Panel A thin-film transistor liquid-crystal display (TFT LCD) is a kind of LCD that employs thin-film transistor (TFT) technology to increase image attributes including addressability and contrast. In contrast to passive-matrix LCDs or basic, direct-

driven LCDs with a few segments, a TFT LCD is an active-matrix LCD.

Our solution includes both hardware and software, which we must properly combine. The parts that follow will demonstrate how we interfaced hardware and software.

OpenCV is an Intel-created and Willow Garage-maintained image processing library. The most recent update is version 2.2, which is available for C, C++, and Python. It's free and open source. It's simple to use and set up.

Python language is a high-level, interpreted, interactive and object-oriented language. This programming language which is designed to be highly readable where it frequently uses English keywords. This language support variety of hardware platform due for its writability, error reduction and readability.

Linux is a family of free and open-source software operating systems built around the Linux kernel. Typically, Linux is packaged in a form known as a Linux distribution for both desktop and server use. The Raspberry Pi was designed for the Linux operating system, and many Linux distributions now have a version optimized for the Raspberry Pi

.

X. IMPLEMENTATION

Hardware implementation

The Raspberry Pi board has various wide variety of ports to communicate with other devices in the world. In that DSI (Display Interface) port is one of the ports to which we have connected Raspberry Pi to LED screen display. camera is connected to one of the 4 USB ports in the Raspberry Pi board will show the python file to start the shopping. It gives information how to use the QRcode and removing button in the smart shopping trolley.

Software Implementation

Once the hardware is interfacing is completed then we need to jump to software implementation. To run any computer, we require Operating System (OS). In this solution we are using original Raspbian stretch OS to run our RPI board. Raspbian is developed based on Linux platform and it is open source. We need to download it from raspberrypi.org website and install it in SD card, which can be placed at the SD card slot of RPI board. After inserting SD card in RPI board, turn on the board by giving power supply from power bank. Once the Pi booted it will show the desktop screen which having plenty of options to operate the mini computer. Later we need to install the python3 packages using Linux terminal window. The important aspect in software is programming. We have developed algorithm and implemented it by using python language. The web page runs on the digital display panel. The web page is developed using HTML, CSS and java script.

XI. RESULT AND DISCUSSION

1.The main aim was to design and build a prototype and implementation of a shopping trolley for. The hardware and software were well integrated together.

2.The proposed model is achieved with providing the comfort easy and ready to go shopping experience.

3.This system helps not only the customers but also the shop owners to increase their profit when the customers are in more numbers as they experience the taste of comfort zone.

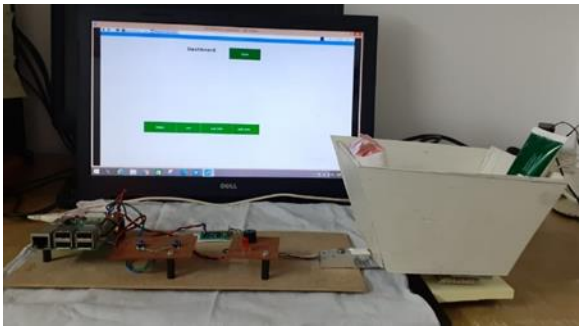


Figure 3: Set-up of the System

XII.FUTURE WORK

- By using tracker, we can track the trolley.
- Pay Bill using face detection and fingerprint.
- To make user feels more comfortable and easier to use, mobile application should implement to this system. This is because nowadays everyone carries a smartphone when leaving for shopping; hence, it would much easier for user to use the mobile application to create the shopping list whenever possible.
- This innovation can be utilized at air terminals on account of its wireless nature and its capacity to guarantee better security.
- Currently the web application design for the user are not convenient and less effective. To make

user feels more comfortable and easier to use, mobile application should implement to this system.

- Besides that, mobile application can also include features such as notification for shopping list, daily sales of certain groceries or user preferences for the groceries.

XIII CONCLUSION

Considering the changing trend in retail shopping, we conclude that the Intelligent Shopping Basket is most certainly a definite necessity for the Retail marketing industry to step up their portfolios, cope up with the advancement in technology and save time and manpower. The proposed model is easy to use, low-priced and does not require any special training. The device is simple to operate and does not need any help. This model keeps an account and uses of the existing developments and various types of radio frequency identification and detection technologies which are used for item recognition, billing and inventory update. As the whole system is becoming smart, the requirement of manpower will decrease, thus benefiting the retailers. Theft in the mall will be controlled using this smart system, which further adds to the cost efficiency. The time efficiency will increase phenomenally since this system will eliminate the waiting queues. More customers can be served in same time thus benefiting the retailers and customers as well.

REFERENCES

[1] Dr. Suryaprasad J, Praveen Kumar B O, Roopa D & Arjun A K "A Novel Low-Cost Intelligent Shopping Cart", 2014 IEEE.

[2] Amine Karmouche, Yassine Salih-Alj, "Aisle-level Scanning for Pervasive RFID- based Shopping Applications", 2013 IEEE.

[3] Mr.P. Chandrasekar, Ms. T. Sangeetha, "Smart Shopping Cart with Automatic Central Billing System through RFID and ZigBee", 2014 IEEE

[4] Base Paper: The RFID Based Smart Shopping Cart Ms. Rupali Sawant, Kripa Krishnan, Shweta Bhokre, Priyanka Bhosale Student, Mumbai University,2019

[5] Control Theory and Informatics ISSN 2224-5774(PRINT) ISSN2225-0492(ONLINE), VOL1, NO1, 2016 RFID Based Automatic Shopping Cart Saurabh Kumar Sultaina, Gourav Jaiswal, Prateek Jain.

[6] INTERNATIONALCONFERENCE ON COMPUTING AND CONTROL ENGINEERING (ICCCE2012), 12&13 APRIL 2018 Smart Shopping Experience Based On RFID.VANITHA

[7] Dr. Suryaprasad J, Praveen Kumar B O, Roopa D Arjun A K, A Novel Low-Cost Intelligent Shopping Cart, Proceedings of the 2nd IEEE International Conference on Networked Embedded Systems for Enterprise Applications, NESEA 2011, Perth, Australia, December 8-9, 2016.

[8] Swati Zope, Prof. Maruti Limkar, “RFID based Bill Generation and Payment through Mobile”, International Journal of Computer Science and Network (IJCSN), Volume 1, Issue 3, June 2018.

[9] G. Roussos and B. College, “Enabling RFID in Retail”, Computer, IEEE, vol. 39, no. 3, 2006, pp. 25-30.

[10] Cisco Internet Business Solution Group survey document, My Shopping My Survey Finding Available:http://www.cisco.com/web/about/ac79 /docs/retail/Mashop-surveymetrics UNITED STATES.pdf

[11] J.American Time Use Survey. Available: http://www.bls.gov/tus/charts/