Volume 8, No. 3, March – April 2017

ISSN No. 0976-5697

International Journal of Advanced Research in Computer Science

CASE STUDY AND REPORTS

Available Online at www.ijarcs.info

A Fast Cloud Based Pervasive Method of Cart Billing System for Supermarket Using Real Time Technology

M. Jothibasu
Assistant Professor, Department of ECE,
PSG Institute Technology & Applied Research, Coimbatore, 641062, India

S. Boopathy
Assistant Professor, Department of ECE,
KSR Institute for Engineering and Technology, Tiruchengode, 637215, India

***Abstract*:** The concept of smart shopping for non – contact item detection brings value to the technology and future as well. Embedded automation plays vital role in modernizing the world. The fusion of online and offline trading has become a significant pivot point of the Internet Era. Under the existing operation structure of supermarkets, this article aims to propose a smart shopping method based on IOT technology [1], [2], [3], [4]. The system includes smart card for user (RFID) [5], GSM module, ATM card swipe machine, bar code reader, display, weight sensor [6], Wi-Fi module and Arduino UNO board [11]. The entire setup will placed in the rack. The customer can easily purchase the product and pay the cash by online. There is a provision to send the bill to the registered mobile number. The weight of any product can be measured by customer itself instantaneously using weight sensor.

Keywords: ARDUINO UNO, Smart Card, Wi-Fi module, GSM module, bar code reader, IOT, weight sensor.

I INTRODUCTION

In this fast paced world, people would love to shop all their products under one roof in mega stores like Walmart, HEB etc. and the system used in these mega stores is the one that has been around for a very long time and everyone is familiar with it and is arguably out of date. The major issue with today's system is the unnecessary stop at the checkout line when a shopper is finished gathering items (Fig No 1). It involves a lot of unnecessary waiting and many got frustrated for standing in queues for billing. At the same time, shopper need to remove all the items placed in the cart and arrange in the conveyor for the ease of cashier who is being paid just to scan the items and a helper in some places to place the items back in the cart. This results in a lot of the shopper's time being wasted, adds to congestion near the store's exit, and adds cost for the store which has to pay cashiers and helpers.

Figure 1 Traditional method of shopping

The proposed method will give the prototype for the new shopping methodology in the super market [1], [2]. That is everything will be customer itself. That is purchase of product, measurement of weight, payment of bill and printing the bill via IOT platform [11].

II BACKGROUND STUDY

Current self-checkout systems consist of a scanner and one or more load cells. A customer removes items from their cart or basket, scans them, and places them in the bagging area where each items weight is checked against a value stored on a server. If the item's weight matches the stored value, the machine then allows users to continue scanning more items. If not, the user is alerted to the inconsistency and is not allowed to continue checking out items until they resolve the weight mismatch. Additionally, stores typically station one or more employees near the self-checkouts to help users and prevent shoplifting [6], [7], [8].

Zigbee based system can send the data within the 10 – 20 meters and the data rate is 20 kbps to 250kbps [5].There no provisional to measure weight of the product [3]

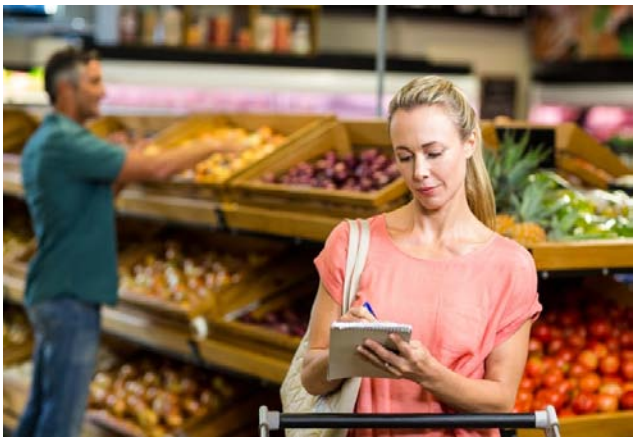

Figure 2 Rechecking of purchased item

Other new techniques such as Express lane and Self-check-out make some relief but it doesn't satisfy all the customers. Even the Express lane and Self-check-out got crowded at peak times. One more problem with the Self-check-out is the average time taken by a shopper to scan and bill all the things. If a un experienced shopper goes for the Self-check-out, it is possible that shopper can take a lot of time to sort out things which make other shoppers to wait [9], [10].

III SSMBS ARCHITECTURE

Weight sensor, GSM, smart card, display, WI –FI device and ATM card swipe machine interfaced to the arduino module [1], [2], [10], [11]. The entire setup will be placed at every three consecutive trays of the rack. The block diagram the proposed Smart Super Market Billing System (SSMBS) methodology as show in figure 3 [1], [2]

All the data will be transferred to the customer via cloud gateway from the micro controller[6], [11]. The entire system power by common power supply unit (Distributed power supply 5V to 12V).

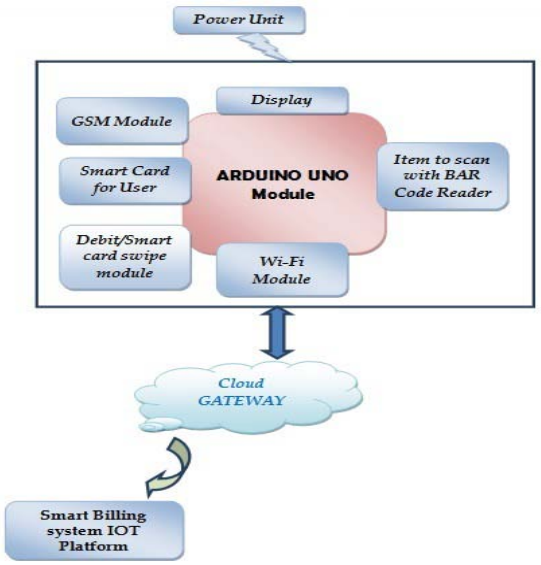

Figure 3: SSMBS Architecture

IV PROCESS OF THE SMART CART

The goal of the Smart cart is to create an easier system for shoppers to use, while cutting down on the costs for the store. This new system involves placing the scanner in each cart which helps the shopper to scan on their own. Shopper's used to travel between aisles for gathering items and scan the items with the scanner attached as they put them into their cart. Once an item has been scanned, the cart which is equipped with a set of load cells reads the weight of the item added to the cart and verifies it with the store's database [4], [5], [6], [7]. This helps confirm the correct item was placed in the cart. In case of having the wrong item, the server will send an alarming signal to the system and thus an alarm will indicate the customer and will not turn off until an action is taken. Similarly, if any scanned item is removed with the weight difference alarm signal will be triggered. When finished shopping, the shopper will be directed to the smart check out system where the bill will be generated based on cart reference id [10]. The carts will be able to leave the store once the customer has checked out. If the customer leaves without paying, an alarm will sound.

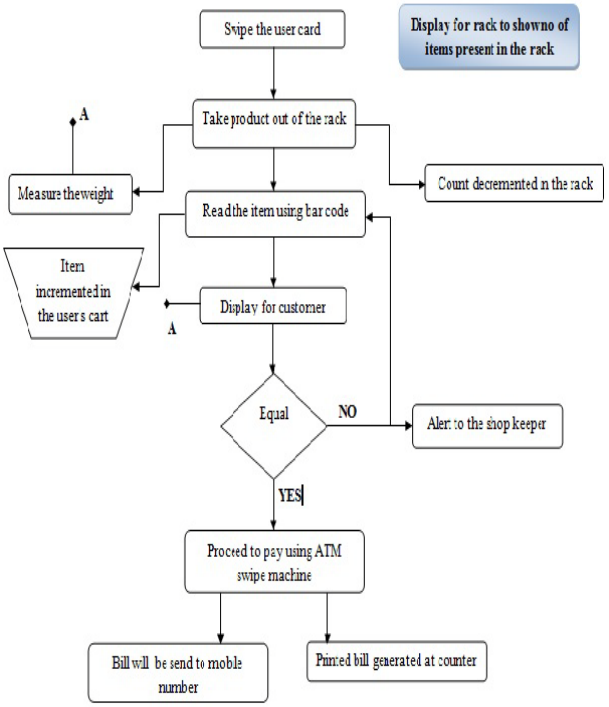

Figure 4: Flow diagram

Once the customer enters into the market, then he/she has to swipe the smart card which is already borrowed by the user [1], [2], [3]. The customer must read the product by bar code reader which he wants to buy it. Once it was read then the display shows the number items purchased. And at the same time count will be reduced from the rack. Weight sensor is used to measure the weight of the product. Once purchase has been finished then the system asks for payment. The bill will be printed and SMS also send to the mobile number as soon as the payment approved [10]. If the product was not read by the reader, then the alert will be generated [7].

V HARDWARE IMPLEMENTATION

(a) ARDUINO UNO

The Arduino Uno(Fig 5) R3 is a open source microcontroller board based on the ATmega328 chip [11]. This Board has 14 digital input/output pins, 6 analog input pins, Onboard 16 MHz ceramic resonator, Port for USB connection, Onboard DC power jack, An ICSP header and a microcontroller reset button. It contains everything needed to support the microcontroller. Using the board is also very easy, simply connect it to a computer with a USB cable or power it with DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to serial driver chip. Instead, it features the Atmega16U2Atmega8U2 up to version R2) programmed as a USB-to-serial converter. While the Arduino UNO can be powered via the USB connection or with an external power supply, the power source is selected automatically.

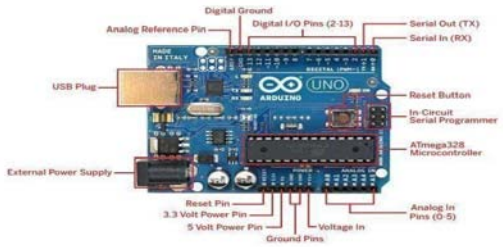

Figure 5 Arduino UNO

(b) LOAD SENSOR

A load cell (Fig 6) is a sensor or a transducer that converts a load or force acting on it into an electronic signal. This electronic signal can be a voltage change, current change or frequency change depending on the type of load cell and circuitry used. There are many different kinds of load cells. We offer resistive load cells and capacitive load cells.

Figure 6 Load cell

(c) INTEGRATION OF LOAD SENSOR

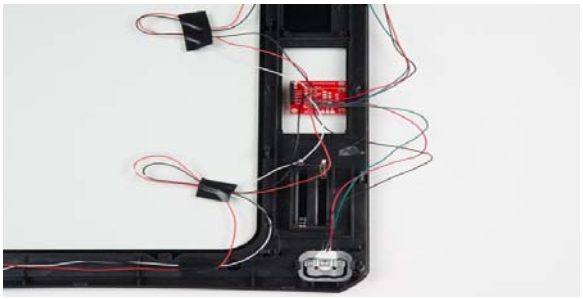

Figure 7 Possible four disc load cell configuration in something like a bathroom scale

Depending on the type of load cell you are using, the configuration of how it should be hooked up to plates or surfaces will change.

The HX711 Load Cell Amplifier accepts five wires from the load cell. These pins are labeled with colors; **RED, BLK, WHT, GRN, and YLW**. These colors correspond to the conventional color coding of load cells, where red, black, green and white wires come from the strain gauge on the load cell and yellow is an optional ground wire that is not hooked up to the strain gauge but is there to ground any small outside EMI (electromagnetic interference). Sometimes instead of a yellow wire there is a larger black wire, foil, or loose wires to shield the signal wires to lessen EMI.

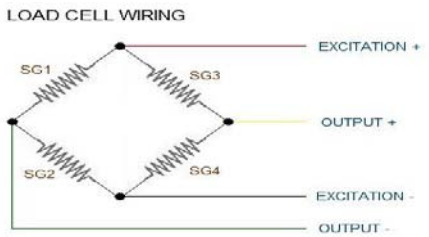

Figure 8 Four strain gauges (SG1 through 4) hooked up in a wheatstone bridge formation

The four wires coming out from the wheatstone bridge on the load cell are usually:

- Excitation+ (E+) or VCC is red
- Excitation- (E-) or ground is black.
- Output+ (O+), Signal+ (S+)+ or Amplifier+ (A+) is white
- O-, S-, or A- is green or blue

Once the load cell is hooked up to the amplifier, you can hook up VDD, VCC, DAT, CLK, and GND to a microcontroller such as a RedBoard or Arduino board.

The example code has **DAT and CLK** hooked up to **pin 3 and 2** respectively, but this is easily changed in the code. Any GPIO pin will work for either. Then VCC and VDD just need to be hooked up to 2.7-5V and GND to ground on your microcontroller.

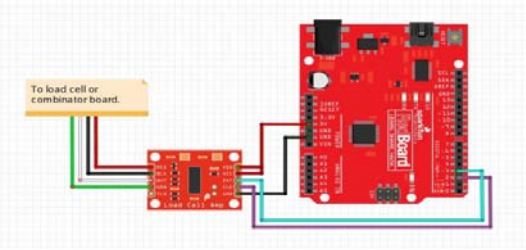

Figure 9 Diagram of HX711 amplifier connected to a Red Board

(d)GSM

Figure 11 GSM Module

GSM is an (Fig 11) international standard for mobile telephones. It is an acronym that stands for Global System for Mobile Communications [3], [10], [11]. It is also sometimes referred to as 2G, as it is a second-generation cellular network. To use GPRS for internet access, and for the Arduino to request or serve web pages, you need to obtain the Access Point Name (APN) and a username/password from the network operator. See the information in Connecting to the Internet for more information about using the data capabilities of the shield. Among other things, GSM supports outgoing and incoming voice calls, Simple Message System (SMS or text messaging), and data communication (via GPRS). The Arduino GSM shield is a a GSM modem. From the mobile operator perspective, the Arduino GSM shield looks just like a mobile phone. From the Arduino perspective, the Arduino GSM shield looks just like a modem. [5], [11]

VI CONCLUSION

In this paper we proposed an idea to implement the smart shopping system which will be installed at every super market. This will enhance the method of purchasing and also the customer can customize themselves depends upon the requirements. Although the several methods are available in the market, this method will have additional features. If suppose the number of borrowed items in the cart mismatch to the count decremented in the rack, then the alert message will sent to the shop keeper and moreover the customer cannot proceed to pay their bill until the number of items gets matched. Once the purchase is over user can pay their bill at instance and the bill will be sent to the mobile number (already registered/ need basis) as well as printer at the counter via wireless module.
Further to this idea, we need to demonstrate in hardware and simulation as well. Touch enabled door system at the rack will be proposed in future so that user can purchase virtually.

VII REFERENCES

[1] Hsin-Han Chiang ; Wan-Ting You ; Shu-Hsuan Lin ; Wei-Chih Shih ; Yu-Te Liao ; Jin-Shyan Lee ; Yen-Lin Chen, “Development of smart shopping carts with customer-oriented service”, published in IEEE International Conference on System Science and Engineering (ICSSE), 2016. Pages: 1 – 2

[2] Yerlan Berdaliyev ; Alex Pappachen James, “RFID-Cloud smart cart system”, published in IEEE International Conference on Advances in Computing, Communications and Informatics (ICACCI), 2016 . Pages: 2346 – 2352

[3] P. Iyappan ; S. Surya Jana ; S. Anitha ; T. Sasirega ; V. Prasanna Venkatesan, “An Enhanced Shopping Model for Improving Smartness in Markets using SABIS architecture” published in IEEE International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET), 2016. Pages: 140 – 145.

[4] Ou Wenxing ; Wang Lei ; Jiang Zhipeng ; Yu Changhong, “Implementation of Smart Shopping System Based on NFC Technology” published in IEEE Seventh International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2015 Pages: 553 – 555

[5] P. Chandrasekar ; T. Sangeetha “Smart shopping cart with automatic billing system through RFID and ZigBee” published in IEEE International Conference on Information Communication and Embedded Systems (ICICES) -2014. Pages 1 -4

[6] Fausto C. Fleites; Haohong Wang; Shu-Ching Chen ,“Enhancing Product Detection With Multicue Optimization for TV Shopping Applications” IEEE Transactions on Emerging Topics in Computing- 2015, Volume: 3, Issue: 2 Pages: 161 – 171.

[7] Gurwicz, R. Yehezkel, and B. Lachover, “Multiclass object classification for real-time video surveillance systems”, Pattern Recognition .Lett., vol. 32, no. 6, pp. 805 - 815, Apr. 2011.

[8] D. Liu, M.-L. Shyu, Q. Zhu, and S.-C. Chen, “Moving object detection under object occlusion situations in video sequences," in Proceeding of IEEE International symposium on Multimedia (ISM), Dec. 2011, pp. 271 - 278

[9] A. Vazquez-Reina, S. Avidan, H. P□ster, and E. Miller, ``Multiple hypothesis video segmentation from super pixel flows," in Proc. 11th Europian. Conference on Computer Vision. (ECCV), 2010, pp. 268 - 281.

[10] Remy Magnier-Watanabe, “An Institutional Perspective of Mobile Payment Adoption: The Case of Japan”, published in 47th Hawaii International Conference on System Sciences – 2014.Pages: 1043 – 1052.

[11] S.Boopathy ; N.Ramkumar ; “Controlling the Boiler Temperature of Tea leaves by using Android Application and ARDUINO UNO” published in International Journal of Modern Computer Science (IJMCS), 2016. Pages 57 -60

AUTHOR’S BIOGRAPHIES

Mr Jothibasu M received his Bachelors of Engineering degree from PSG college of Technology in 2010 and the Masters of Engineering degree from Kongu College of Engineering in 2012. He is currently working as an Assistant Professor in the Department of ECE at PSG Institute of Technology and Applied Research, Coimbatore. His area of interest includes signal processing, embedded systems and biomedical engineering. He published two papers in international journals. He also published four papers in international and national conferences. He had four years of teaching experience.

Mr Boopathy S is currently working as an Assistant Professor in the department of ECE at K S R Institute for Engineering & Technology, Tiruchengode. He received his M.E in Embedded System Technologies from Regional Center, Anna University Coimbatore in 2014. He pursued his B.E in Electronics & Communication Engineering from Bannari Amman Institute of Technology, Sathyamangalam, and Tamilnadu, India in 2012 with distinction. He had published four papers in international journals. He also got two proceedings in international & national conferences. He is a life member of ISTE. He had two years of teaching experience.