International Journal of
INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING
ISSN:2147-6799 www.ijisae.org Original Research Paper

IoT-Based Smart Billing System using RFID and Mobile Application

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Submitted:11/03/2024 **Revised**: 26/04/2024 **Accepted**: 03/05/2024

Abstract: Modern technology has raised the quality of living for people today. Even though there is era of online shopping but still people use to go for offline shopping for purchase of grocery items by visiting the nearby mall or shopping complexes. This has been observed that waiting in billing queue line is one of the tedious jobs which people don't like while shopping. To escape from crowd during billing, this paper presents an IOT based billing system through which customer can quickly check out once done with shopping. An RFID-based smart shopping device is used on shopping basket/trolley which can be linked with customer smart phone with help of Bluetooth technology. As soon as customer put the product in basket it gets scanned and reflected in customers smart phone and as well as on admin console. At the end customer only settle the final bill after it is generated. The experimental results of paper have significantly reduced to cut down on the amount of time needed for the invoicing system and make verification of products at customer end too.

Keywords: *Android, Bluetooth, RFID, Arduino Nano, GSM*

1. Introduction

During offline shopping, Customers perform a lot of manual work like from picking of right product to standing in long queue for billing. Based on survey, it is found that customers are opting for online shopping in order to avoid long waiting queue during billing which they face in shopping malls. Everyone faces difficulties in offline purchasing platforms is managing billing queues during a drawn-out billing procedure. Therefore, the objective of this paper is to decrease the usual amount of time shoppers spend in malls by implementing an automated billing system that makes use of Radio Frequency Identification (RFID)[1] technology. The goal of this work is to please the customer and shorten the time on checking out by making use of RFID technology. Understanding radio frequency transmission is essential to completely understanding RFID. The foundation of RF (Radio Frequency) communications is the transfer of data via electromagnetic waves. When a specific electromagnetic wave is generated at a source, its affects can be felt by a receiver located a long distance away from the source and can be recognized and decoded. In systems with RFID, an RFID tag that has the tagged data for the item emits a signal with the relevant data. The processor can then process the information for the intended reason after the processor receives the signal from the RFID reader. Therefore, these two elements-RFID tag and RFID reader combined work into an RFID system. A RFID reader's antenna, transceiver, and decoder all work together to send out periodic impulses that help it recognize neighboring tags. The data processor receives each signal the tag transmits and processes it. The information processing subsystem provides the means for handling and storing data.

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In literature many automated billing [2] system were proposed using IOT[4][6], Bluetooth, L-FI[3] and Zigbee[7] technology. This paper not only pro-posed a smart basket[5][9][10][11][12] with IOT based framework but also integrate hardware with mobile application and short message system (SMS) facilities for smooth transactions during shopping.

2. Methodology

Fig.1 shows the system architecture of proposed system where tags are present on every piece of merchandise in the market. A processor-mounted RFID reader picks up the code from merchandise when a customer places an object in the cart. The processor reads the name of the product, price, and other information after matching the code with those in memory. Customer can verify the information about the item(s) added to cart, including its name, price, and overall cost on the LCD as well as on mobile application. Once the payment is completed, the customer will receive SMS of confirmation via GSM module.

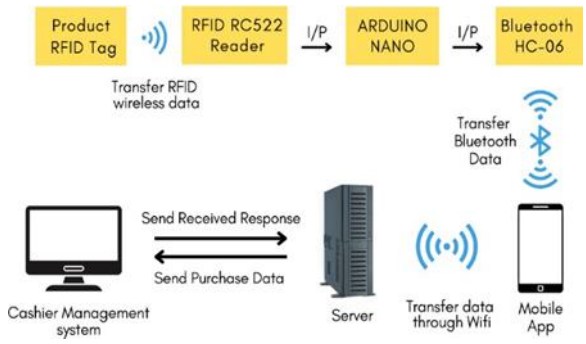

Fig 1: System architecture

Fig. 2 shows the flow of system, where user with first login to the mobile app and login using credentials, In order to connect with IOT device, customer will select the Bluetooth and get connected. Customer can add products into the

basket as each product has RFID tag which get scanned by RFID scanner and scanned item will get displayed on LCD as well as bill of item will be reflected on mobile application. If user want to remove the scanned item from basket then user will take out the item from basket which results in RFID scan out and product will removed from the billing transaction. Once customer is done with adding of required items, customer can proceed for payment to the billing counter where admin can receive payment through card or cash.

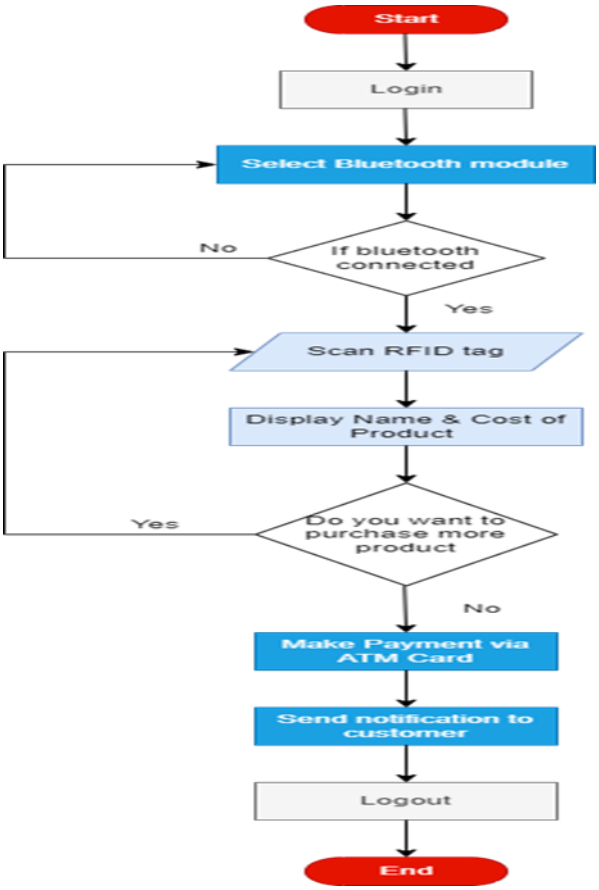

Fig 2: Flowchart IOT-Based Smart Billing System using RFID and Mobile Application

During experimentation, different hardware devices are used as shown in fig..3 and their detail description is as follows

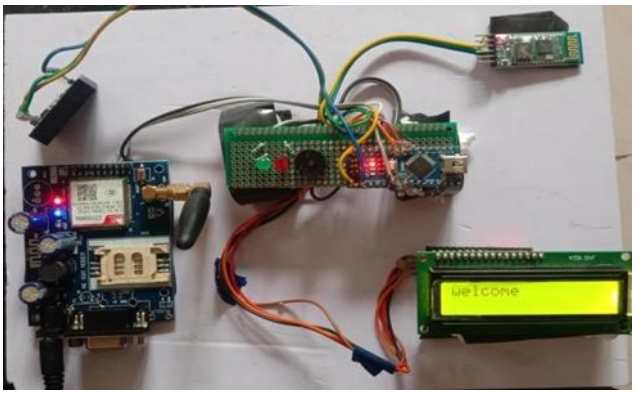

Fig. 3: IOT based Hardware

A. Arduino Nano

The Arduino Nano provides a wide range of features for interacting with other microcontrollers, PCs, and his other Arduino gadgets. A UART TTL (5V) serial link is provided by the ATmega328 on digital pins 0 (RX) and 1. (TX). The hardware and software used by Arduino are created with artists, designers, hobbyists, programmers, newbies,and anyone else interested in interactive spaces and products in mind. Switches, LEDs, speakers, GPS, cameras, the internet,cell phones, and TVs can all be connected to an Arduino device via communication protocols.

B. RFID-Reader

The majority of the data is gathered beginning with the RFID tag using a device called a radio frequency identity reader. Each item can be identified using an RFID barcode straight fromthe product packing. But barcodes are unableto do this. This identifier may contain case-related data. It was previously used inside the mall during display hours because every objectthere has a barcode. The suggested system calls for RFID tags rather than barcodes on every item. After the RFID tag is turned on,the RFID scanner removes any subtleties in the area around the tag while continuing tocheck for breakage.

C. Buzzer

The bell emits a tone. Ringtones, which can betiny but mighty components as shown in Figure 5, should have insensitive properties in your system. Since it is compact and has conventional 2-pin construction, it can be usedon PCBs, bread boards, and even single tables,making it a common component for most electrical requirements. Buzzers that needassistance typically fall into one of two categories.

D. Bluetooth

Serial wireless data transfer can be readily accomplished using a Bluetooth module . One of the most widely used 2.4 GHz frequency regions is where it operates. Adopt the Bluetooth 2.0 plus EDR specification. With Bluetooth 2.0, devices transmit signals 0.5 seconds apart from one another, which significantly lessens the burden on the Bluetooth chip and cuts down on Bluetooth sleep time. The HC-05 Bluetooth Class 2 Slave module was created for open wireless serial transmission. The process is clear to the user once it has been paired with an expert Bluetooth device, such as a computer, smartphone, or tablet. The serial input instantly transmits every bit of data that is received wirelessly.

E. GSM

Messages are sent and received using the Global System for Mobile Communications, or GSM. The Arduino

GSM Shield makes use of the GSM library to allow your Arduino board to connect to the Internet, transmit and receive SMS, and make voice calls. Already working with the Arduino Uno, the shield.

F. Libraries /Packages

With the help of LCD I2C library, Arduino/Genuinoboards can control a completely text-based LCD that is built on the Hitachi HD44780 (ora similar chipset). Both 4-bit and 8-bit versionsof the library are functional. All Arduino boards have access to this library. With the help of this library, Arduino boards can control LCDs, which are frequently built using the Hitachi HD44780 (or a comparable chipset). It is primarily built on a text-based LCD. Both 4- bit and 8-bit versions of the library are functional. Serial clock (SCL) and serial statistics (SDA) pins are used by the controller on the Arduino board to transmit pulses at regular intervalsand send and receive statistics among the two devices, respectively. A single bit of information, which can be used to shape in sequence the address of a chosen tool and an instruction or statistic, is transmitted from the playing surface to the I2C tool over the SDAas the clock line changes from low to high (known as the growing edge of the clock pulse). This data will be sent in bits, one at a time The referred to as upon tool performs the request and, if necessary, transmits its statisticsback to the board over the identical line, utilizing the clock signal produced by the Controller on SCL as timing. Since the I2C protocol lets in for every enabled tool to have its exact deal with, and as each controller and outside gadgets take turns talking over a singleline, an Arduino board can communicate (in turn) with many devices, or distinct forums whilst the use of simply pins of your microcontroller. The Software SerialCollection was created to allow serial communication using software applications that mimic functionality over the different virtual pins of the Arduino .On pins 0 and 1, the Arduino hardware includes built-in support for serial transmission.. AUART, a piece of circuitry built into the chip, is used to provide local serial support. As long as there is room in the 64-byte serial buffer, this hardware enables the At-Mega chip to continue communicating via serial while other tasks are being performed. With a speed of 115200 bps, you can run multiple serial software applications simultaneously.

3. Results and Discussion

Fig. 4, Fig.5, Fig. 6 and Fig.7 shows the different modules of mobile based application which is integrated with hardware to smooth out the shopping process. Experimental results shows that RFID is better option than barcode reader as barcodes require line of site and should be placed within their precise boundaries when item is being scanned. Secondly, barcodes, get hampered by changes in temperature, moisture, physical abrasion, and other factors whereas RFID identifiers are more resilient and facilitates and improves reading accuracy. RFID's is used in this work with consideration of its range of coverage, the proposal ultimately led to an effective result whereby RFID technology replaced barcodes.

Fig.4: Login screen

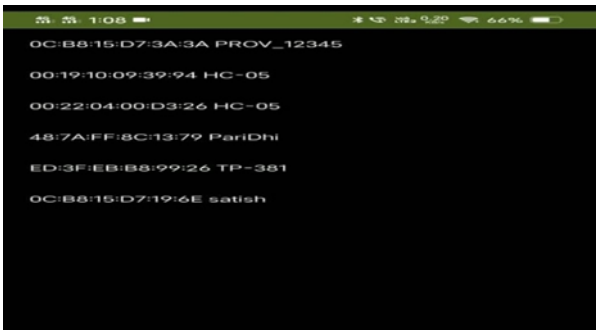

Fig. 5: Connectivity module

Fig. 6: Connectivity Status

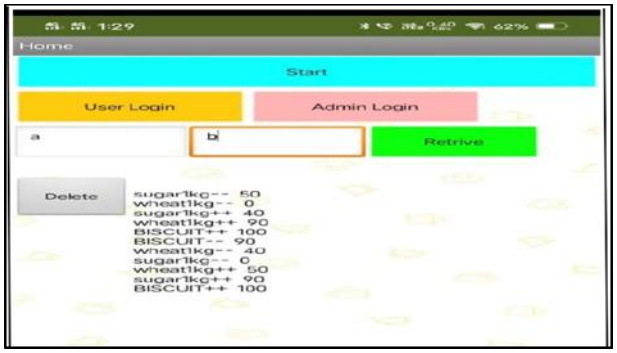

Fig. 7: Purchase Item details

In addition to bill information on mobile, SMS facility is also embedded on circuit to get SMS of total bill.

Conclusion

Through this paper, RFID technique with mobile application and SMS facility is proposed for smart shopping, this technology facilitates time savings and simplifies people's lives. Each time a product is added to the purchasing cart, read the description, and save the information. Once all goods are completed added, the server will modify the billing state of that cart. Billing departments instantly produce invoices so that clients can handle their own billing. Therefore, intelligent carts for shopping and billing systems based on RFID can speed up and stream-line client shopping. People envision a time when they can reside anywhere as technology develops daily. Therefore, this paper discussed how to make simple and convenient purchases of goods in this essay on RFID- based smart trolleys which can further enhanced by integrated voice assistance.

References

[1] Chandrashekhar P, Ms. T. Sangeetha―Smart shopping cart with automatic central billing system through RFID and zigbee‖, IEEE,2014.

[2] Hubert, M. Blut, C. Brock,C. Backhaus and T. Eberhardt ―Acceptance of smart phone based mobile shopping: mobile benefits, customer characteristics, perceived risks and the impact of application context",IEEE 2018

[3] Shipra Aggarwal, Himani Pangasa, An analysis of LI-FI based prevalent automated billing systems in shopping malls, International conference of computing methodologies and communication (ICCMC), 2019.

[4] Muhib A Lambay, Abhishek Shinde, Anupam Tiwari, Automated Billing Cart, International journal of computer science trends and technology, volume 5, 2017.

[5] .Sudipta Ranjan Subudhi, RN Ponnalagu, An intelligent shopping cart with automatic product detection and secure payment system, IEEE 16th India council international conference, 2019.

[6] B Vishwas, Apoorva, Swathi V Raidurg, IOT application on secure smart shopping system,International journal of advanced research in computer science, vol 9, 2018.

[7] Pravina B. Chikankar, Deepak Mehetre, Soumitra Das, An Automatic Irrigation System using ZigBee in Wireless Sensor Network, 2016 International Conference on Pervasive Computing (ICPC).

[8] Sneha Angal RFID & Arduino Based Automated shopping cart System International Journal of Science & Research (IJSR)Volume 5 Issue 7, July 2016

[9] Bhagyashree K.Chate , Prof.J.G. , Smart trolly system using Raspberry pi and Beacon Module. International Research Journal of Engineering & Technology (IRJET), 2016,

[10] Suprabha Jadhav1, Shailesh Hambarde, android based Automated cart System using Raspberry Pi and GSM, International Journal of Science & Research (IJSR), Volume 5 Issue 6, June 2016.

[11] Nikhil Agrawal, Smita Singhal Intelligent shopping cart using NFC, Arduino, Volume 9 Issue 3, December 2018.

[12] Runinian Li, Tianyi Song, IOT applications on secure smart shopping system, IEEE internet of things journal, volume 4 issue 6, 2017

[13] Bijal K Thaker,"Low-Code Platforms and Business Process Transformation", International Journal of Technology Engineering Arts Mathematics Science Vol. 2, No. 2, December 2022, pp. 20~23 ISSN: 2583-1224