Secure purchasing system on Internet of Things Applications

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Abstract - *In current world today's life going to departmental store for purchasing is increasing rapidly. People take the product and put it into purchase basket. After done with purchasing they go for billing at the Billing counter but as there are many people standing in Queue for billing purpose, So lots of time is required for the individuals for billing because of existing barcode technology. To reduce this time, overcome as proposed system based on RFID technology. The system contains the items attached with RFID tag, RFID reader which reads the tag information when put into the purchase basket. Then this information is send to main billing server which calculates the total amount of purchased items and sends the calculated bill to the device attached to purchase basket for displaying it on LCD. Along with this system we are implementing an Android application for controlling the purchase basket movements. The application is based on the purchase basket number and total amount of purchased product.*

***Key Words*: Internet of Things (IoT), Radio Frequency Identification (RFID), Zigbee Technology, android**

1. INTRODUCTION

INTERNET of Things (IOT) is the network of physical objects embedded with radio frequency identification (RFID), embedded systems, sensors, network, and software that enable physical objects to collect and exchange data for a common goal.

Everyday objects can now be equipped with computing power and communication functionalities, allowing objects everywhere to be connected. This has brought a new revolution in industrial, financial, and environmental systems, and triggered great challenges in data management, wireless communications, and real-time decision making. Additionally, many security and privacy issues have emerged and lightweight cryptographic methods are in high demand to fit in with IoT applications. There has been a great deal of IoT research on different applications, such as smart homes, e-health systems, wearable devices.

In this paper, we focus on a smart shopping system based on Radio Frequency Identification (RFID) technology, which has not been well-studied in the past. In such a system all items for sale are attached with an RFID tag, so that they can be tracked by any device equipped with an RFID reader in the store –for example, a smart shelf. It becomes easy for the store to do inventory management as all items can be automatically read and easily logged. We propose the use of
ultra high frequency (UHF) RFID technology in the smart shopping systems, as UHF passive tags have a longer range, from 1 to 12 meters.

1.1 Existing System

Previous research on the design of smart shopping systems mainly focused on low/high frequency RFID which have inadequate ranges, and leave customers to manually scan items with RFID scanner. In the existing system, humans are used for monitoring the product quality and quantity in supermarket, so the manual faults may occur.

1.2 Proposed System

In our proposed system, each smart cart is equipped with a UHF RFID reader, a micro controller, an LCD touch screen, a Zigbee adapter, and a weight sensor. The smart cart is

able to automatically read the items put into a cart via the RFID reader. A micro controller is installed on the cart for data processing and a LCD touch screen is equipped as the user interface. In order for the smart cart to communicate with the server, we have chosen Zigbee technology (data exchange purpose) as it is low-power and inexpensive.

We have a weight scanner installed on the smart cart for weighing items. We also set a RFID reader before the exit door to check that all items in the cart have been paid for. We consider security and privacy issues related to smart shopping systems as no previous research has tackled it. This system is automatic monitoring the product quality and quantity so the customer satisfaction is achieved by using this concept.

2. Architectural Design

2.1. System Architecture

Each trolley is attached with Product Identification Device (PID). Through ZigBee communication, PID device sends its information to automated central billing system, where the net price of all the purchased products is calculated. Customer can get their billing information at the billing or packing section according to their trolley Identification Number. Even there is no need for a cash collector, if in case a customer uses their debit/credit for the net bill payment. The automated central billing system consists of a ZigBee transceiver and a server/system connected to access product database.

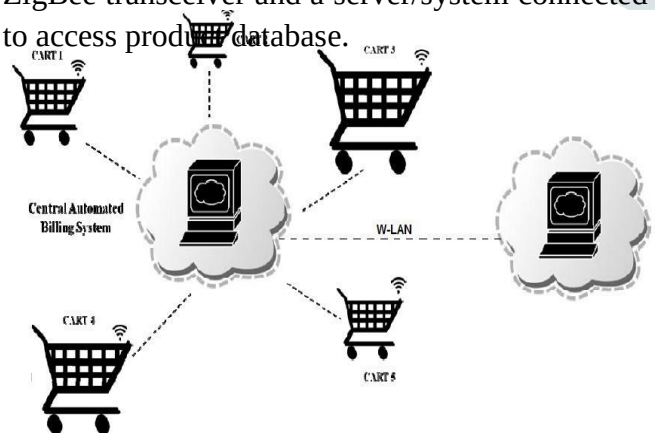


Fig.1. Central Automated Billing System product database

2.2 Hardware Architecture

Each trolley in supermarkets or malls is attached with One device which consists of hardware components such as RFID reader, micro-controller, EEPROM memory and Liquid crystal display (LCD).

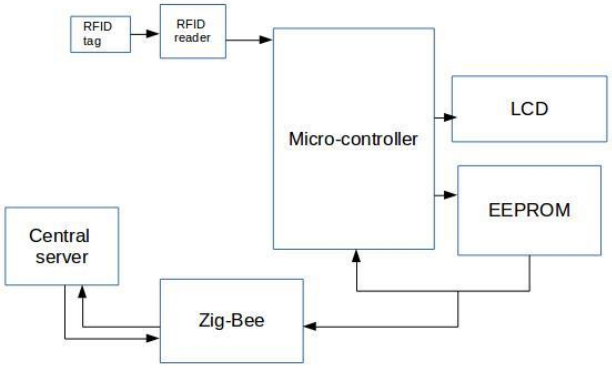


Fig. 2. Hardware architecture of system

3. SYSTEM WORKING

All trolleys in the supermarket are attached with the device which contains the RFID reader, microcontroller, Zigbee. So each trolley will send the item information to the main billing server for calculating the final bill of purchased items.

To send information of each trolley we are using Zigbee as it has some advantages over Bluetooth and Wi-Fi. Working is started when the customer enters to the supermarket and takes the trolley. The RFID reader in the trolley is paired to android app for bill generation. When the customer puts the items the RFID reader reads the data, then it is send to the EPROM through the microcontroller. By using Zigbee this data is get sent to main server for fetching cost of the item, so that cost details are displayed on the LCD attached to the trolley. If the customer wants to remove the item from the trolley, then cost of that item gets subtracted

from the total bill during the process. At last the bill gets calculated in the main server.

The android application is divided into two parts which includes trolley movement controller and outline map display. The android app is first paired with the trolley to control the movements. The map shows the outline of the shop which shows the customers where the particular items

are present. This sets the purchase in ease. It becomes easy for the store to do inventory management as all items can be automatically read and easily logged on to.

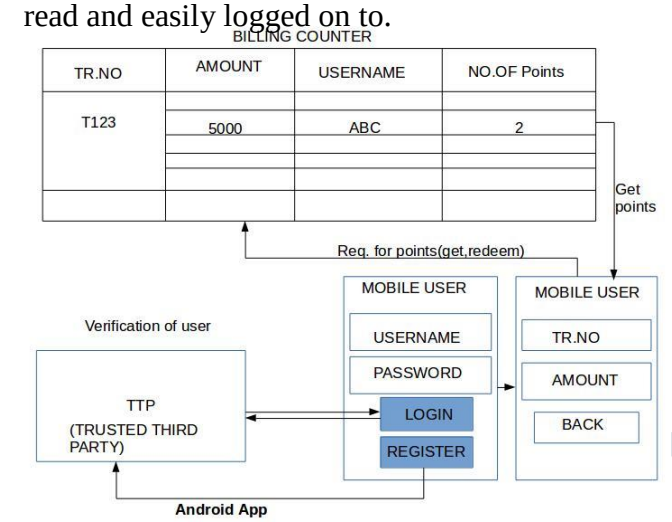


Fig.3. Android application interface

3.1. ALGORITHM

Step1: Start

Step2: Initialize System

Step3: Put the item attached with RFID tag into trolley

Step4: RFID reader reads the tag information

Step5: Reader sends the data to the microcontroller

Step6: Microcontroller send the data to the sever using ZigBee

Step7: Server calculate the bill and send back to trolley

Step8: Final Bill get displayed on LCD

Step9: If customer wants proceed then go to

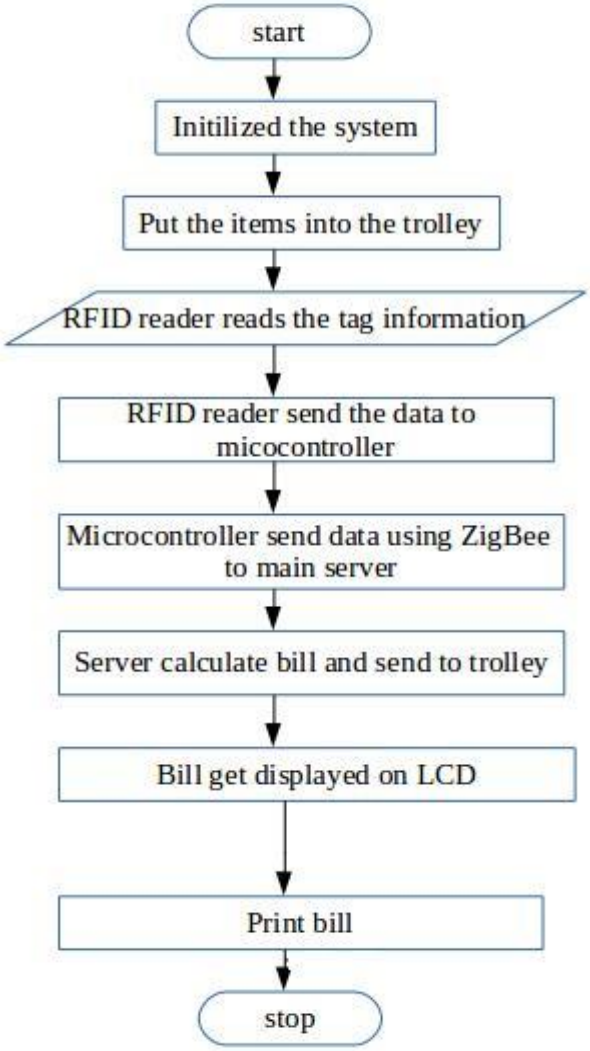
Step10 else go to Step12

Step10: Create account on Android application

Step11: Server generates the bill and prints the bill

Step12: Stop

3.2. FLOW DIAGRAM



5. CONCLUSION

This work aims to provide an insight into the RFID –based production data analysis for production control in the IoT enabled smart job-shops. Thus the system creates the automatic bill of the purchased items from the trolley using trolley number. This process saves the time of customer and also reduced the man power in the malls. So ultimately it becomes a easiest way of the shopping. Also with this system the reward point system gets implemented using Android application. The objective behind the application is that to replacing the existing cards based system by android application. So the intended objectives were successfully achieved in given system.

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