RFID based Shopping Cart with Web App

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Abstract – *In recent years, Manufacturers are developing products that ensure comfort for all people. One of a trait that is evolved will be providing them with a trouble-free shopping experience. In Online shopping Experience, we cannot tactile the essence of the product but the people can get the tactility of the product and can manually compare it with other brands in a shopping mall. When shopping in a mall, customers are unaware of the total bill amount till the end of shopping. Also, customers don't have any idea of the location of a product. For a single product purchase, customers are required to wait in a long queue at the billing counter. These problems can be tackled by adopting new technologies. RFID (Radio Frequency Identification) technology and web application are the primary technologies used for designing our system. The shopping cart is integrated with Raspberry Pi and RFID hardware module which recognizes the RFID tags attached to products. The RFID reader interfaced with Raspberry pi scans ID stored in a tag and displays the information of the product fetched from database into the web app with its amount. The web app can be run on any browser on smart phones or on portable devices. Along with this, sections of the products are displayed on the basis of their order of sorting in a mall. The in-app wallet is used for payment of the bill. We have used RFID technology to implement the project.*

I.   INTRODUCTION

The automation industry is now blooming with the new technologies and providing assistance in many fields. Radio-Frequency Identification is abbreviated as RFID. It depicts tiny electronic devices that which consist of a small chip and an antenna and is capable of carrying 2,000 bytes of data or less. Generally, RFID Reader and RFID Tags are the two classes of it. Mainly three types of tags are available i.e. active tags, passive tags, and battery-assisted passive tags. An active tag has a built-in battery and transmits RFID signals periodically whereas passive tag has no any battery. The passive tag transmits signals only when connected to an external battery. The battery-assisted passive tag has a small incorporated battery thereby enables only when in contact with RFID reader. We have used passive RFID tags to implement this project because they are cost-effective and not require any complex setup when attaching to any product.

The RFID Tags are containing information which may be a single binary bit or be a large array bit. The RFID readers are used to read those RFID Tags. The RFID devices they can be used for the identification, tracking objects etc. The RFID device presents the same purpose as a barcode or a magnetic strip on a transactional card; it provides a unique identifier for that object. The RFID device must be scanned to get back the identifying information relating to it, which is in the same manner as a bar code or magnetic strip must be scanned to get the information. RFID technology has the power to eradicate the Barcode Technology with its increasing use and also more economical than the Barcode. RFID overcomes the Barcode in terms of reading the items as for the Barcode it needs to be in the Line of Sight. Also, they are as cheap as the Barcode scanner if purchased in the bulk.

II.   LITERATURE REVIEW

A. Suganya. R, Swarnavalli. N, Vismitha. S, Mrs. G. M. Rajathi they had proposed "Automated Smart trolley with Smart Billing using Arduino" in March 2016. This paper proposed a system in which the system is placed on the Cart. The Cart consists of the Product Identification Device (PID) that contains parts like a microcontroller, LCD and RFID Reader. Every product in the mall is consisting of the RFID Tag, when an item is put into the trolley then it is identified by the reader and the products information is displayed on the LCD and the cost is also displayed on it which is part of PID. After completion of shopping there an upload key is presented and when pressed then the further bill is transferred to PC by the Bluetooth module and later generates the bill [1].

B. In addition, we have studied more about some other projects which include "A New Technology of Smart Shopping Cart using RFID and ZIGBEE" proposed by Komal Machhirke, Priyanka Goche, Rupali Rathod, Rinku Petkar, Manohar Golait in the year 2017. They have proposed a system where the RFID Reader is mounted on the Cart. Considering the mall the products are consisting of the RFID tags. When an item is dropped in the cart then it is scanned and the price is stored in memory. The products added they have displayed on the LCD screen. The bill is generated by receiving the data by some RFID modules from cloud database of web [2].

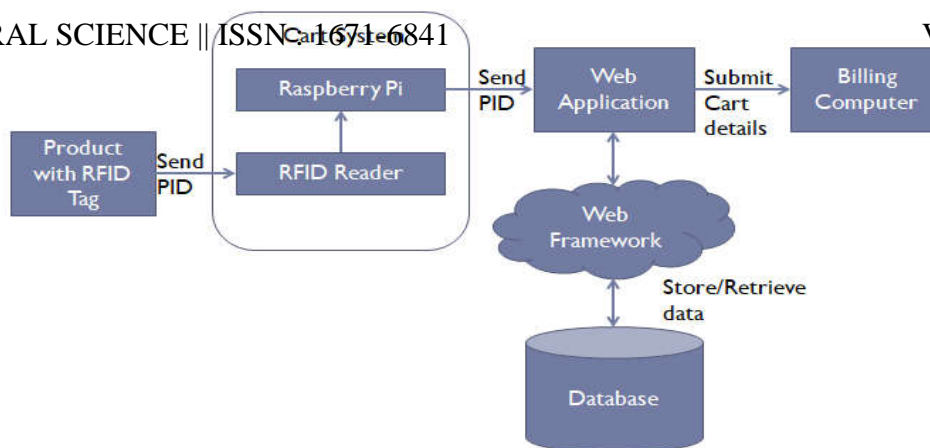## III.   SYSTEM ARCHITECTURE

Figure 1: System Architecture of overall project

The figure 1 shows system architecture, which explains the internal working of our project. It also explains the cart system that contains interfaced units of Raspberry Pi and RFID Reader. The web application stores the read product id (PID) to database through web frameworks and it simultaneously submits cart details to billing counter after customer hits submit button.
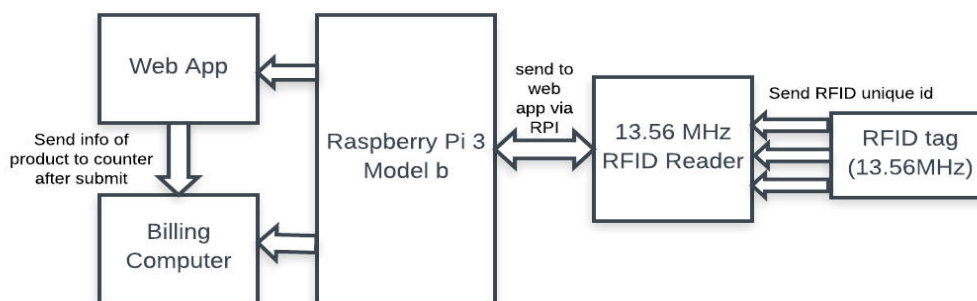
IV. BLOCK DIAGRAM

Figure 2: Block Diagram of Interfacing Units

V. WORKING OF SYSTEM

These days so many advanced technologies are evolving by which people are concentrating more on online facilities and digitalization. Automation and Smartphone technology are the leading ones by which people can manage their time accordingly. Development of these two technologies enables a new tactic to e-marketing.

Our system primarily consists of two sections shown in figure 2. One is the integration of RFID reader with the Raspberry Pi 3 model b and the second is a web app which accesses the cart information for user convenience. After entering the shopping mall take the cart which is integrated with the 13.56MHz RFID reader interfaced with Raspberry pi 3 model b and open the web app on their smart phone's browser. Each product in the mall has an RFID tag of the same frequency as a reader. Each RFID tag has a unique Id which is stored in the central database manually at the time of attaching to a product. First, register and login to the web app. When a customer adds the first product in the cart, the cart's unique id (Raspberry Pi & its IP address) stored in his account on database and product information is fetched simultaneously by comparing product's id on the database. The above two actions are via Wi-Fi. The information includes product id, its description, available offers on it and price which can be displayed in the app. Now onwards, as the customer adds a product to cart, the information of it and total amount to be paid is displayed on the app. At the time of exit, the customer has to hit the submit button in the app and the purchase information is sent to billing computer via Wi-Fi for checkout. Billing computer generates the bill automatically and sends it to the users account for payment. The customer can now pay the total amount through the app wallet.
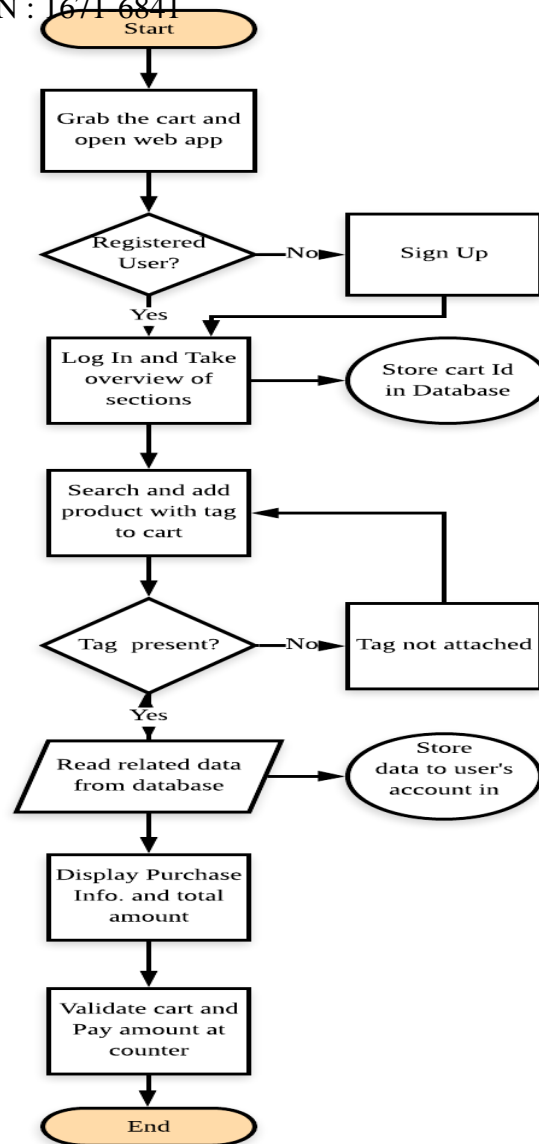
VI. SYSTEM FLOWCHART

Figure 3: Flow diagram of System

VII. SYSTEM DESIGN

The system consists of following modules:

A. *Shopping Cart unit*
   Each shopping cart in the mall is integrated with a hardware unit which has an RFID reader and a Raspberry Pi.

B. *RFID Reader*
   We used a 13.56MHz Mifare RC522 RFID Reader unit for reading the RFID tag's Id. The RFID reader sends radio frequency signal to RFID tag and in turn, the tag sends its Id to RFID reader. Therefore RFID reader operates as a transmitter and receiver for RF signals. The carrier frequency is generated by an oscillator circuit and contact of data commands on carrier signal is made by a modulator in the reader. These two circuits act as a transmitter. Demodulator gathers data, which works as a receiver.

C. *RFID Tags*

As we have used an active RFID reader, we can attach a passive RFID tag for each product. The tag has a unique Id which is set manually through external applications before attaching to product.

D. *Raspberry Pi 3 Model B*

We can use Arduino Uno board but the tag Id required to send to billing counter and to web app from the RFID reader. This can be done by using Raspberry Pi 3 which sends tag Id via built-in Wi-Fi module. Arduino requires an external Wi-Fi module that has to be interfaced to it. RFID reader is interfaced with Raspberry Pi using Serial Peripheral Interface (SPI) protocol. The protocol is written in python language.

E. *5V Battery*

Each Raspberry Pi requires a 5V power supply to work steadily. Currently 9V battery power supply is available. We will be converting a 9V battery power supply to 5V battery power supply.

VIII.   METHODOLOGY

When RFID reader communicates with a RFID tag, it sends out commands using radio frequency waves. RFID tags will responds by sending unique id or additional information stored in it. If more than one tag come under the range of radio frequency waves emitted by RFID reader (which means if more than one product added to cart) then all tags responds to the RFID reader at the same time. This leads to the unique id or information exchange at the RFID reader side and wrong information supply. This situation is called tag collision. To avoid this, we have written an antiCollision function in python language which gives an error message and it will not be added to the billing. Customer has to add that product to cart once again.

IX.   CONCLUSION

The Important fields of application of "RFID based Shopping Cart with Web App" are shopping malls, super bazaars, grocery shops, E- gadgets etc. It can play a crucial role when there is much more crowd in the shopping mall as it reduces the time required for billing. Because of in-app wallet, the customers don't have to stand in a long queue for payment. This makes the shopping trouble-free and well-off. In addition, the billing facility avoids the queue at the check-out so that the better shopping experience for customers can be created. In future, we extend this research for inventory system.

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