Electronic Smart Trolly Using RFID and Arduino

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***Abstract*: In metro cities we can see you a huge rush at shopping malls on holidays and weekends. This becomes even more when there are huge offers and discounts. Now a day's people purchase a variety of items and put them in the trolley. After total purchasing one should approach counter for billing purpose. By using Barcode reader, the cashier prepares the bill which is a time-consuming process. This results in long queues at the billing counters. This project presents an idea to develop a system in shopping malls to overcome the above problem. To achieve this all products in the mall should be equipped with RFID tags and all trolleys should be equipped with a RFID reader and LCD screen .When one puts any product in the trolley its code will be detected automatically, the item name and cost will be displayed on the LCD, thereby the cost gets added to the total bill. If we wish to remove the product from the trolley, you can take away the product and the amount of that specific product gets deducted from total amount and the same information passes to the central billing unit via Bluetooth module. Hence the billing can be done in the trolley itself thereby saving a lot of time to the customers.**

***Index Terms*: Arduino UNO, RFID tag, LCD, RFID reader, Trolley, Bluetooth, Smartphone**

I. INTRODUCTION

Individuals have constantly created innovation to bolster their requirements as from the start of humankind. The fundamental reason for development in innovation is ought for more independency and this leads to improving tasks and making regular one simpler and speedier. One significant task that individuals invest maximum measure of energy is in shopping. Shopping Centre is a spot where individuals get their everyday necessities running from sustenance items, garments, electrical machines and so forth. Some of the time clients have issues with respect to the unspecific data about the item marked down and misuse of superfluous time at the counters. In this innovative world, each grocery store and supermarkets utilize shopping trolleys with a specific end goal to help clients to choose and store the items which they expect to buy. Customers usually purchase the products required and place them in their carts and thereafter wait at the counters for payments of bills. The payment of bills at the counters is really troublesome and time-consuming process which thereby increasing a heavy crowd at the counters. As indicated by a study directed by US Department agency, on a normal, people spend through 1.4 hours consistently on shopping. A considerable number of clients will tend to leave a line if the line is too long. The present Shopping environment can be essentially be characterized into two classifications [1]

Shopping in absentia is upheld from various perspectives including web shopping, online shopping, and so forth which will not require the buyer to be manually held at the Counters. Purchasing in-individual includes an individual call at location of purchasing and choosing items in view of different variables including need, comfort, brand, and so on. The proposed keen Shopping basket framework plans to help shopping in-individual that will minimize the time spent in shopping. Persistent change is required in the customary time spent at the counters to enhance the nature of shopping background to the clients. To beat these issues expressed above and to enhance the current framework, we have composed a Shopping basket[2]. This can be done possible by basically connecting RFID labels to the items and reader with a LCD in the purchasing cart. From this framework client can possess data related to cost of each thing which are inside cart and furthermore absolute cost of the thing about the item. This framework will save time of clients and labour required in shopping centre with respect to cost of the item .

II. EXISTING SYSTEMS

There are several technologies available for Instinctive Recognition systems. In words of implementation, price necessity and the method associated single or a blend of results are selected for Instinctive Recognition effectiveness

Barcode Systems

This implementation contains a double code comprising of exhibit of bars and spaces organized in parallel design as depicted in figure below. The sequence is of broad with limited bars and spaces which are depicted numerically and alpha numerically. This is done by optical laser scanning. Inspite of same in their material implementation there are much more contrast among the code designs.

Figure 2.1 A typical Barcode system

Biometric Procedure

Biometrics is the science of computing and having magnitude methods involving human beings. It makes use of approaches to differentiate living beings by error free and unique physical characteristics. In implementation they include thumb marking, palm marking methods, vocalized recognition and optic disk recognition

Smart Card

Smart card is an automated information application probably with extra calculating magnitude which is blended into a plastic card as shown in the figure. These cards are furnished by energy and timer beat from the machine through the touching exterior. Information shift between the machine and the card takes place through a two guiding sequential connector[3]. One of the primary benefits associated with the smartcard is that the information saved in it can be defended in opposition to not suitable approach and exploitation. The disadvantage mainly involved with the contact-based smartcard is the susceptibility to corrosion, dirt. Also, the reader machines that are used often are also expensive to sustain because their accountability to fade.

Figure 2.2 A typical Smartcard

RFID systems

In RFID systems information is stored on an automatic information transfer equipment. This is more or less similar to Smartcard. Although the electrical discharge to the information transfer device and the statistics swap are attained with no use of touch like in smartcards but by using magnetic or electromagnetic scopes. A model of RFID system is presented in the figure beneath. Because of the numerous benefits of this when compared to alternate recognition systems these are going to get enacted all around**.**

Figure 2.3 A typical RFID system

III. PROPOSED SYSTEM

The proposed system in this paper will be implemented into two parts. First part is the initialization of the Arduino UNO for the set-up of RFID Reader and Bluetooth. Second part is the tag detection of products by RFID Reader which are placed in the cart and sending of product information from cart to Central billing unit through Bluetooth.Pleasedonotreviseanyofthecurrentdesignations.

The overview working of this system is - This proposed system works as on customer getting into the mall, she/he first takes a trolley. Every cart is connected with a RFID reader, an Arduino Uno and LCD screen. When the customer starts dropping products into the trolley, tags will be read by the reader and the reader sends the information to the Arduino board. An Arduino board compares the information with the data already stored in it. If the data matches then the cost of that product will be displayed on the LCD screen for user. If the user wishes to remove any product from the cart then they can take away that product from trolley and cost of that particular product will be subtracted from the total amount instantaneously and after shopping the products data with total amount gets transmitted to the central billing system through Bluetooth. The RFID Reader will be placed in the mid position on the base/bottom inside the trolley[5]. The cart is designed in such a way that the outer part of the trolley will be covered with RF(Radiofrequency) shielding in order to make sure that the RFID reader will not read any products associated with tags outside the cart.Figure 3.1 shows the block diagram of proposed system in which reader is connected to Arduino UNO which in turns gets connected to LCD and Bluetooth which then sends billing information to Central Billing unit.

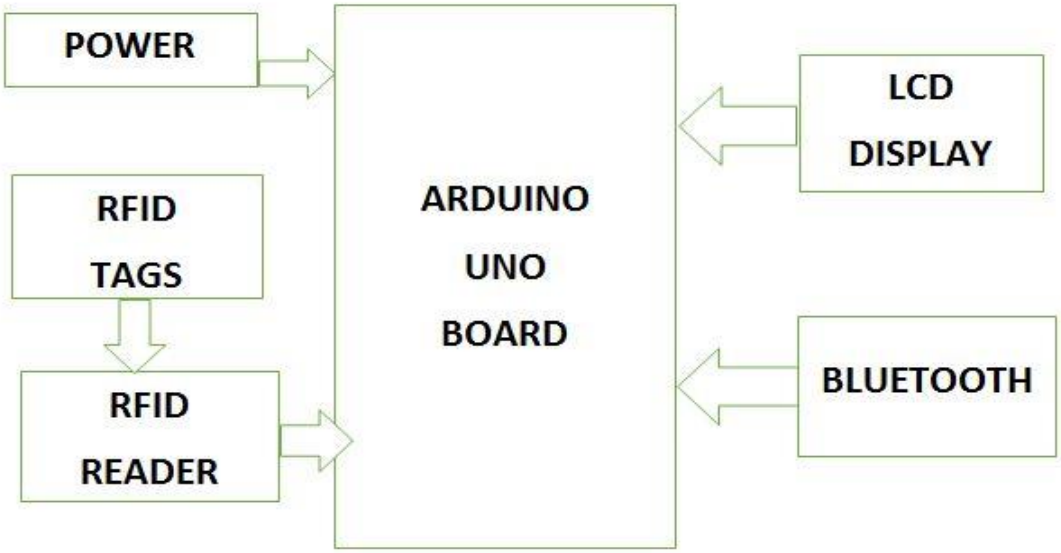

Fig: 3.1: Block diagram of proposed method

At the transmitter section the reader detect the tags and sends the data to Arduino UNO which then compares it with the data stored in it and displays on the LCD Screen attached to tithe Bluetooth transmitter sends the information displayed on LCD. Bluetooth receiver present at the Central Billing unit finally prints the data sent by the Bluetooth transmitter.

COMPONENTS INVOVLED

RFID Reader Module

EM-18 RFID scanner module uses a RFID reader which will read a hundred twenty-five kilohertz tags. So, it will be known as a low frequency RFID reader. It offers out a serial output and contains a range of regarding 812 cm. There is a inbuilt antenna and it are often connected to the laptop with the assistance of RS232. RFID Reader Module, are also called as interrogators. They convert radio waves returned from the RFID tag into a type which will be passed on to Controllers which can make use of it. RFID tags and readers need to be tuned to a similar frequency so as to communicate[6].

Figure 3.2 RFID Reader modules

Arduino Uno

The Arduino UNO is an open source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with set of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 5 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable Arduino UNO) is one of the types of Arduino boards. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping aimed at students without a background in

electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IOT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software too, is open-source, and it is growing through the contributions of users worldwide[8].

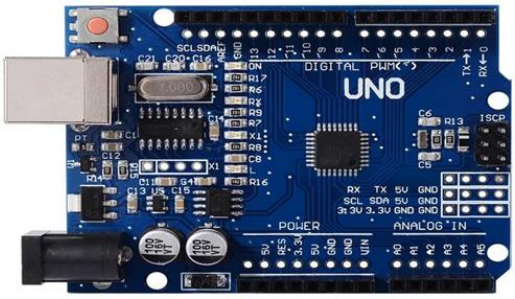

Fig 3.3 Arduino UNO

Bluetooth Module

Bluetooth is a wireless LAN technology designed to connect devices of different functions such as telephones, notebooks, computers (laptops and desktop), cameras, printers, coffee makers, and so on. Bluetooth LAN is an ad hoc network, which means that the network is formed spontaneously, the devices sometimes called as gadgets, find each other and make a network called piconet. Bluetooth technology has several applications. Peripheral devices such as a wireless mouse or keyboard can communicate with the computer through this technology. Monitoring devices can communicate with sensor devices in small health care Centre. Home security devices can use this technology to connect different sensors to the main security controller. Today Bluetooth technology is the implementation of a protocol defined by the IEEE 802.5 standard.

Bluetooth is a high speed, low power consumption microwave wireless link technology, designed to phones, laptops and portable equipment together. Unlike infrared Bluetooth does not require line of sight positioning of connected units. The current prototype circuits are contained on circuit board 0.9 cm square, with a much smaller single chip version in development. When one Bluetooth product comes within range of another (this can be set to between 10 cm and 100 m) they automatically exchange address and capability details[11]. They can then establish a 1 megabits/s link (up to 2 Mbps in the second generation of the technology) with security and error correction, to use as required. The radio operates on the globally available unlicensed radio band, 2.45 Ghz and supports data speeds of up to 721 Kbps as well as three voice channels. Each device has a unique 48-bit address from the IEEE 802 standard. Connections can be point to point or multipoint. Maximum range is 10 meters but it can be extended up to 100 meters by increasing the power[9].

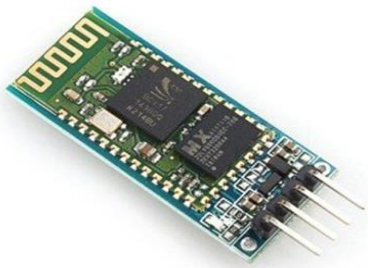

Figure 3.4 Bluetooth HC_02 Module

LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and notice a wide vary of applications. A 16x2 display is extremely basic module and is extremely ordinarily utilized in various devices and circuits. These modules are most well-liked over seven phases and different multi segment LEDs. The reasons being: LCDs are economical; simply programmable; haven't any limitation of displaying special & even custom characters (unlike in seven segments), animations and then on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this digital display every character is displayed in 5x7 picture element matrix. This digital display has 2 registers, namely, Command and information[10].

Figure 3.5 LCD Display 2X16

RFID Card

A radio frequency identification reader (RFID reader) is a device accustomed gather data from an RFID tag that is employed to trace individual objects. Radio waves are accustomed transfer knowledge from the tag to a reader. RFID may be a technology similar in theory to bar codes [12]. However, the RFID tag doesn't get to be scanned directly, nor will it need line-of-sight to a reader. The RFID tag it should be among the vary of an RFID reader, that ranges from three to three hundred feet, so as to be scan. RFID technology permits many things to be quickly scanned and permits quick identification of a specific product, even once it's encircled by many different things. RFID tags have not replaced bar codes due to their price and the need to singly determine each item[9]

IV. IMPLEMENTATION AND RESULTS

Testing of the system with various products

The Paper is evaluated with different trial cases for every 1cm with three distinct items assessed for all the practical trials inside the trolley of length 60 cms with the reader keeping at Centre position in the trolley. Rate of detection also depends on the material of the product with which the tag is attached.

Figure 4.1 shows how detection rate of reader changes with flexible plastic products inside the trolley. The x axis corresponds to distance and y axis corresponds to time. This product contains very low thickness-based packaging so there is constant detection rate for almost all the distance except at few points.

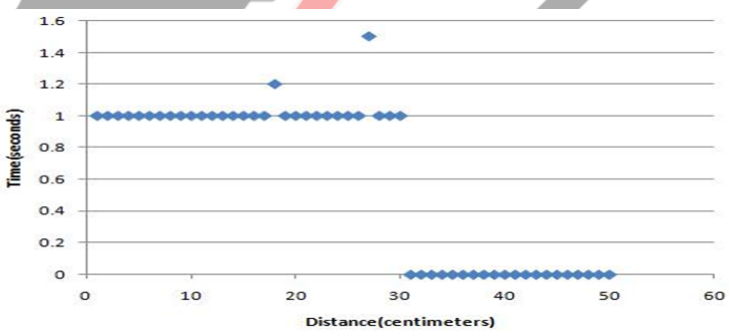

Figure 4.1 Detection rate for flexible plastic products in the trolley

Figure 4.2 shows how detection rate of reader changes with removal of flexible plastic products from the trolley. The x axis corresponds to distance and y axis corresponds to time. There is no consistency in the removal rate of first tag and second tag but the third tag is showing constant removal rate.

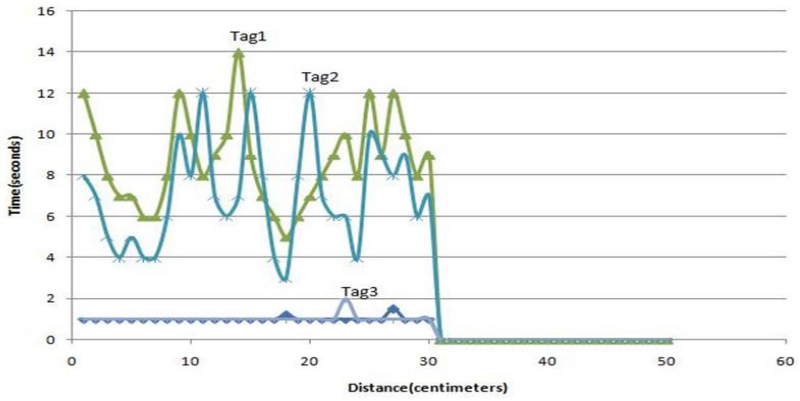

Figure 4.2 Detection rate for removal of flexible plastic products from the trolley

Figure 4.3 shows how detection rate of reader changes with distance for rigid plastic products inside the trolley. The x axis corresponds to distance and y axis corresponds to time. Rigid plastic products are made up of HDPE, LDPE plastic which have good rigidity and so detection rate was constant till some distance and has been fluctuating continuously.

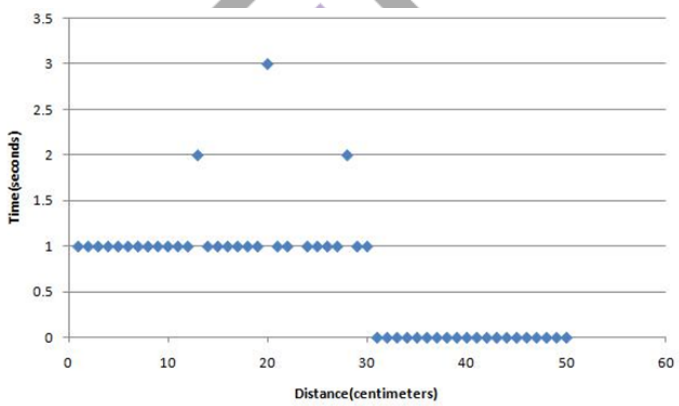

Figure 4.3 Detection rate for rigid plastic products in the trolley

Figure 4.4 details how the detection rate of reader changes with distance for removal of rigid plastic products from the trolley. The x axis corresponds to distance and y axis corresponds to time. Removal rate for first tag is changing steadily whereas removal rate for second tag is lower when compared to first tag while the third tag is showing constant removal rate.

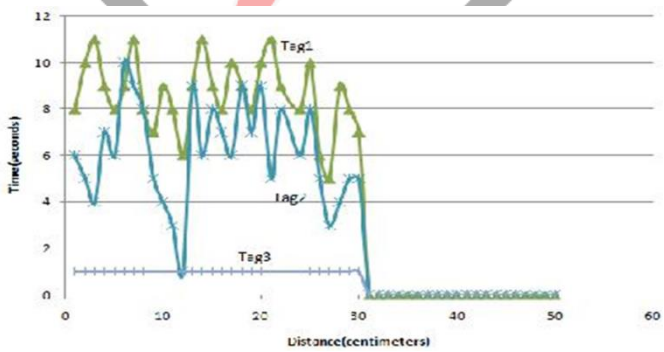

Figure 4.4 Detection rate for removal of rigid plastic products from the trolley

Figure 4.5 details how the detection rate of reader changes with distance for tin free steel products inside the trolley. The x axis corresponds to distance and y axis corresponds to time. This product contains very less percent of steel with chromium in its packaging and this is because rate of detection is changing with distance at few points.

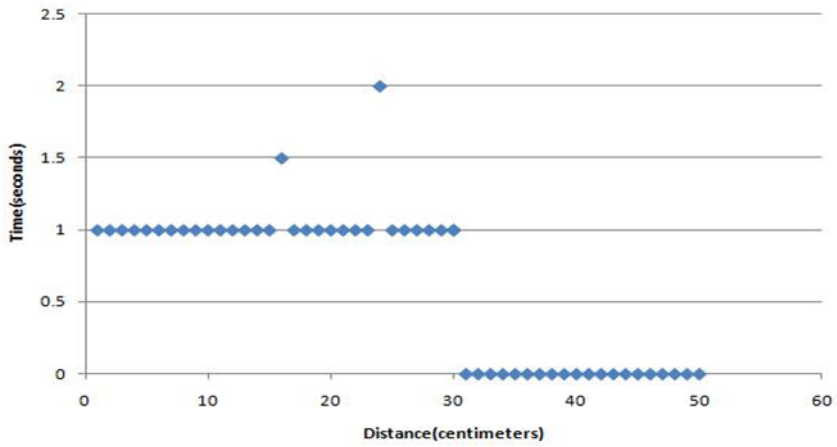

Figure 4.5 Detection rate for tin free steel products in the trolley

Figure 4.6 details how the detection rate of reader changes with distance for removal of tin free steel products from the trolley. The x axis corresponds to distance and y axis corresponds to time. The first and second tags removal is changing constantly whereas the third tag removal rate is constant.

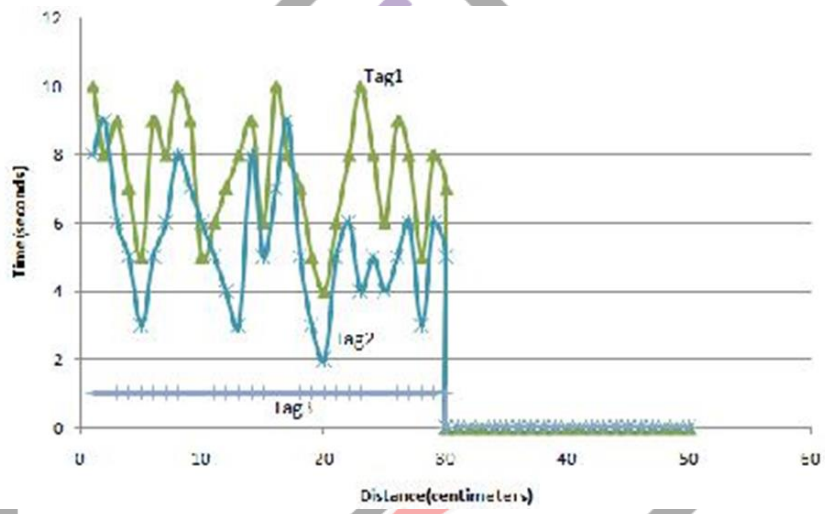

Figure 4.6 Detection rate for removal of tin free steel products from the trolley

V. CONCULSION

The advancement in science and technology is a persistent process. Latest gadgets and latest technology are being designed and developed. This application is used in shopping malls for assisting customers by saving a lot of time in buying commodities. In this project RFID is used as safety access for the item which thereby enhances the surveillance performance. This implementation initiates for an automated central billing system in shopping malls and supermarkets. With this, shoppers no longer have to wait near counters for payment of bills because of their purchased item information getting transferred to central billing unit. By this billing process speed increases and becomes much simpler. In addition to this capability, the mechanism also assures recognition of cases of theft induced by fraudulent consumers which makes the system more reliable and fascinating to both customers as well as sellers. This will enhance the shopping experience to a new level.

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