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SMART SHOPPING BASKET

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***Abstract*— In modern India where people talk about smart cities and India as a digitizing nation, it is very important that we start with necessities of citizens. Grocery shopping is one such necessity that requires modernization. There has always been a long queue at the billing counters in shopping malls. This activity many times consumes lot of time which results in frustration amongst customers. This problem is faced by everyone. Especially in India where there is a lot of population and not enough billing counters. There are online grocery stores available, but they have their own disadvantages like minimum bill value etc. To overcome this problem an idea has been developed which can be implemented in all the shopping malls to save customer's precious time and simplify the billing process.**

In a country like India where cost is an important parameter, it is important to keep in mind the manufacturing cost of the product. If the cost is low without compromising the functioning, the model can be implemented on a larger scale. Considering this the model has been built with the most commonly available and efficient hardware. This paper describes the idea of smart shopping basket and how it can be built using basic cost-efficient hardware. In the proposed model, Radio Frequency Identification (RFID) has been used to detect grocery items. Every product will have a RFID tag and every cart will have a reader. A RFID reader is used to decode the tag and display the information on a small Liquid Crystal Display (LCD). Technical working of the circuit with hardware specifications has been discussed and ways of optimization have been suggested. Different variants of this idea have been studied from research papers and a simplified and effective model with working has been proposed in this paper.

Keywords*— *Automatic Billing, Smart Shopping, Bill, Liquid Crystal Display, Radio Frequency Identification, Customers.

I. INTRODUCTION

Technology plays a vital role today in our everyday life. It not only makes our life easier but also efficient. Time is an important factor which no one wants to waste in menial things. Standing in long and tiring queues at the billing counters in a shopping mart is a common scenario which most of us face in our day to day lives. However this wait time can be significantly reduced using an innovative idea of this Smart Shopping Basket. This being the motivation behind choosing the project. In the recent past, Internet of Things is being significantly used in various commodities. The proposed model is built on the same platform and is found very effective. The basic principle behind working of this circuit is the decoding of RFID tags and extracting the information about the selected product. The extracted information is displayed on LCD so that customer can know the details of the product purchased. The total bill is displayed on the screen. Each product in the store will have a RFID tag which will contain information like manufacturing and expiry date along with cost of the product. This will help customers to keep a track of their bill while shopping and hence budget can be monitored. As the bill is generated real time while shopping it will reduce the wait time at billing counters and allow faster checkouts. Online payment option can also be integrated in this model so that waiting at the counters can be skipped.

This algorithm and technique has been implemented in stores in foreign countries and is found very efficient and time saving. Further advancements in the idea can include image processing algorithms and real time payment systems. Products can be tracked real-time and their information can be decoded using image processing technique. The cart can also be integrated with mobile platform so that customers can keep a list of products they want to purchase and know where they are located in the store. Significant time can be reduced if customers don't have to search for their product after entering the store. Using a mobile platform will also include online payment and hence allowing the customer to completely skip the billing queues. As a complete package this system can be used to build a complete automated store. The described model displays additional information of the product like Manufacturing date and quantity purchased. On scanning the master card (which acts like a payment mode) the bill gets reset and customer is allowed to leave the shop. On scanning the same product twice, the product is removed from your shopping list and the MRP is subtracted from the bill. The total bill is updated after every successful removal or addition of product to the cart.

The paper is organised into subsequent sections as Section two defines basic technologies and hardware used in the prototype. Section three explains working of the circuit and the algorithm used. Section four gives block diagram of the hardware connection. Section five deals with the Results obtained followed by Further Advancements, Conclusion and References.

II. Basic Technology Used

II.A Radio Frequency Identification

Radio Frequency Identification deals with the detection or identification of radio waves and decoding the information from the waves. Radio-frequency identification (RFID) in simplest terms is technology to electronically detect the presence of an object with the help of radio signals. It is used for keeping a track of number of objects in our inventory. RFID is an effective replacement for current bar code technology. The technology is used for automatically identifying a person, a package or an item [2]. The system majorly includes two parts mainly the tag and the reader. It works on the principle of magnetic induction. The reader detects the card whenever the coil inside the tag is activated [2].

II.B Arduino

Arduino UNO is a micro-controller board with Atmega328 IC. It has 5 analog Input pins and 14 digital input/output pins. Each pin is capable of supplying 20mA of current and can provide a maximum output voltage of 5v. It is an open source platform and can be programmed easily. The board supports I2C and SPI communication protocol. The board can be powered by USB type B plug from computer. Also, there is a provision of external power Jack 7v-12v supply. The input supply can be accessed on the pin Vin [1]. There are 6 PWM pins available for controlled duty cycle. The board has a clock speed of 16MHz and internal flash memory of 32KB, 2KB of SRAM and 1KB of EEPROM [1].

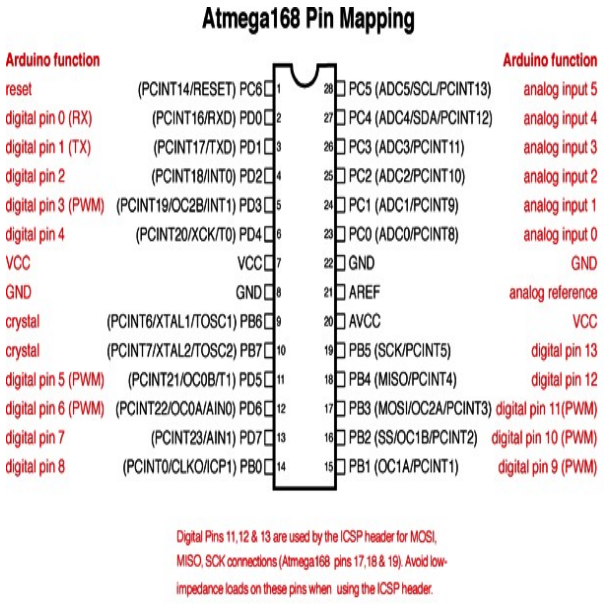


Fig 1. Pin Diagram of Atmega 328

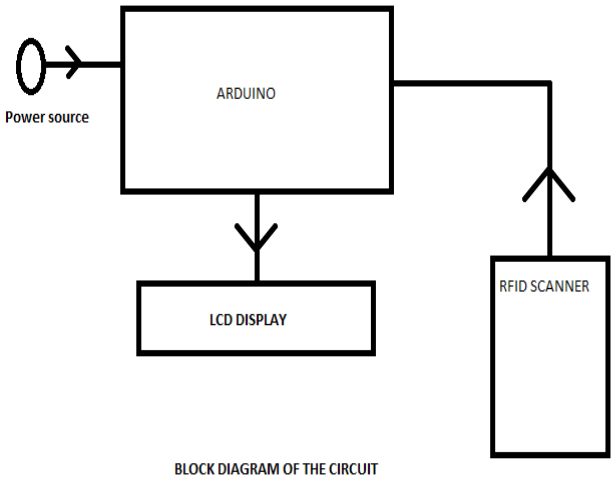
II.C Liquid Crystal Display

A Liquid Crystal Display (LCD) is a type of output device that displays characters on a backlit screen. There are various types of LCD's available, the one used in this prototype is a 16x2 display [3].

III. Working Of The Circuit

The circuit needs to be powered on by a DC adapter(5-20V). When the circuit is switched on the RFID module MFRC522 which works on 3.3v is also powered ON [2]. The circuit starts looking for RFID tags. Whenever a tag is detected its UID is extracted. Every RFID tag has a unique identification number which can be processed to carry out further working of the circuit. In this algorithm when the UID is extracted it is stored in a string and then the string is compared for further instructions. Hence each UID corresponds to a unique product stored in the shop's database. Therefore, whenever the tag is scanned, relevant information is displayed on the LCD and the total bill value is added in a separate variable. If the same card is scanned again the bill value is subtracted from the total bill which indicates that the product has been removed by the customer. There is a separate RFID tag which acts as a master for the system. When the master card is scanned total bill is displayed and the payment is made. The bill value is reset to zero after scanning the card which indicates bill paid. In this way the complete system can be installed in a shopping basket for the convenience of the customer and thereby reducing the effective billing time.

IV. Block Diagram Of The Circuit



BLOCK DIAGRAM OF THE CIRCUIT

As seen from the diagram RFID scanner is an input device to the Arduino which provides unique ID of the tag to the controller. After the ID is obtained further processing is done by the Arduino and LCD, which is an output device displays the corresponding result on the screen. Arduino is externally powered from Adapter which can be a battery source as well. RFID scanner and LCD display are powered from the power pins on the Arduino board. RFID works on 3.3v supply pin of Arduino.

V. RESULTS

The circuit was built and assembled in a cardboard box for demonstration purpose.
RFID tags works real time and have a very good response time. The working of RFID is compared with Bar code in the table below

RFID vs. Bar Codes

S.No	Feature RFID	Tags	Barcodes
1	Read more than one item at a time	√	×
2	Read while item is moving	√	×
3	Programmable	√	×
4	Line of site read not required	√	×
5	Lifetime guarantee	√	×
6	Able to resist water damage	√	×
7	Built-in security	√	×
8	Inventory tool without handling items	√	×
9	Able to locate specific items on shelves	√	×
10	Use with borrower self checks units	√	√
11	Use with automatic returns units	√	×
12	Use with automated sorting and handling systems	√	×

Fig 3. Table showing comparison of RFID with Bar code

Interfacing of RFID cards with Arduino understood and implemented using MFRC522 module [12]. The circuit is a low-cost model and very easy to use for the customer and hence efficient. This variant is suitable for Indian market and can be easily implemented in all the stores.

III. V. FURTHER RESEARCH AND ADVANCEMENTS

The idea is quite popular in foreign countries and is being implemented in many shops. All of the used modules can be interfaced via Internet of Things to reduce the wiring and build a centralized billing system in the shop where all carts can be monitored from one server and real time bills can be sent to the customers on their phone. This will also save paper printing. Theft in the shop can be monitored by image processing where each product can be live tracked in the shop [4]. If the product crosses the permitted area without being billed a notification will be sent to owner about the theft.
Hence the idea can be very well developed into an efficient system and implemented on a large scale.

IV. CONCLUSION

A simple idea was implemented and integrated in a working model which is useful for everyone. It will significantly reduce the wait time of customers in shopping queues in super markets and departmental stores.
RFID tags works very well and accurate as compared to barcodes which when tampered cannot be processed.

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