Design and Implementation of Smart Supermarket System for Vision Impaired

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ABSTRACT **- The visually impaired people face a lot of challenges in their routine life. One such challenge is that they have to depend completely on others for purchasing. In this paper a solution has been given to identify and purchase products in the supermarket. This system uses PIC microcontroller and RFID technology. The blind people are provided with low power RFID reader when they step into the supermarket. In the supermarket, products are segregated and placed in the shelves. Each shelf is integrated with a passive RFID tag along with unique ID which describes the category of the product and its specification. The passive tag information is read by the RFID reader and sent to microcontroller. The read tag ID is matched with recorded audio file in the APR9600 IC and played through the speaker which is embedded with the RFID reader. As the recorded audio file is unique to each product and clearly specifies about the product, they can decide about acquiring the item by listening to the audio. On implementing this method, blind people can satisfy their purchasing needs without others support.**
Keywords*: RFID, blind people, smart supermarket, PIC microcontroller, audio file, assistance.*

I. INTRODUCTION

Embedded system provides variety of applications in the human life. The recent advances in embedded system change our lifestyle in a smart way. In our daily life the essential needs get satisfied by shopping our desired products. Due to the technology developments in shopping world most of the supermarkets have introduced smart shopping [1]. Even though we have E-Shopping, the people not satisfied with their purchasing needs. The people can fulfil themselves by purchasing their products in person. Due to high population and lack of time people may face the difficulties in choosing and purchasing the required items. Especially in the case of visually impaired people, they cannot able to purchase products without others support. To overcome their difficulties we propose a system that provides assistance for blind people to purchase products in the supermarket [2]. This system improves their lifestyle as well as their confidence level in shopping. The proposed system uses PIC microcontroller and RFID (Radio frequency Identification) technology. To identify the products in the supermarket RFID technology is used [3]. Identification is the core concept in user-oriented applications and ubiquitous computing. RFID technology is used for identification and to authenticate tags that are mounted in any product or individual [4]. It uses radio waves to identify objects and people. Fig. 1 exhibits the basic operation RFID system.

Fig. 1. Basic operation of RFID

Purpose of RFID system is to provide data transmission through the portable tag that is read with RFID reader and processes it according to the application [5]. Information transmitted by using tag offers location or identification along with other specifications of product tagged like expiry date, weight, and its price. The RFID system has many applications and gradually replaces the barcode system.

II. PROPOSED SYSTEM

A. RFID

The RFID system consists of a passive tag and reader. Passive tags are preferred because it does not need external power source. The low power RFID reader reads the tag information and transmits the data to the microcontroller. The readers and tags are operated at a frequency of 125 KHz.

B. APR9600

APR9600 is a single chip used for high quality voice recording [6]. It reproduces the voice signals in their natural form. The APR9600 is a device with non-volatile storage and able to playback the recorded voice for 30 to 60 seconds. It can play multiple messages in both random and sequential mode. The designer can select its sampling rates and playback duration depends upon their needs. In this system the IC is used to record the audio file which describes about the product information and its specification.

C. PIC Microcontroller

PIC microcontrollers are highly efficient and low cost devices which maximize the system reliability. The proposed system uses 8 bit PIC microcontroller of series PIC16F877A. It is a RISC processor and follows Harvard architecture [7]. It has an inbuilt 8-channel ADC and Watchdog timer with on chip RC oscillator. It consumes low power with operating voltage range of 2.5V to 6V. PIC16F877A has program memory of 14.3kB and it is widely available. Ports A and E used as I/O pins which can provide multiple functions. Fig. 2 shows the proposed prototype model of RFID based smart supermarket system.

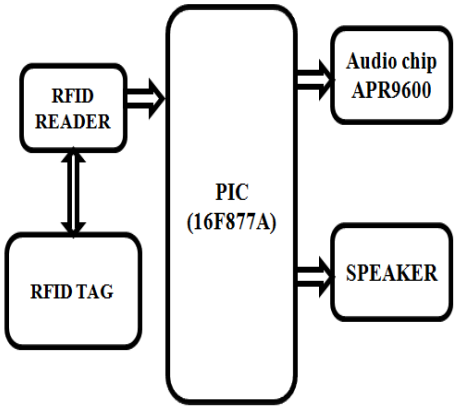

Fig. 2. Proposed system

III. SYSTEM DESCRIPTION

The development and implementation of smart supermarket system is mainly based on RFID techniques [8]. In the supermarket, the products are segregated and placed in shelves. The passive RFID tags are mounted on the each shelf. The tags are energized using radio waves transmitted by RFID reader. To identify the required product an audio file is recorded by using APR9600 IC. The audio file is unique for each shelf which contains the products. The APR9600 is interfaced with the controller. The RFID reader reads the tag information which has a unique code and sent to microcontroller. The microcontroller receives the unique EPIC (Electronic Product Identification Code) stored in the RFID tag and process the code. It is predefined in the microcontroller. Then the received code is matched with the corresponding audio file and played through the speaker. The overall system flow is explained in the flow chart (Fig. 3).

IV. HARDWARE SETUP

Fig. 4 shows the hardware model of the RFID based Smart Supermarket system. PIC microcontroller is programmed in embedded C using MPLAB. The RFID reader is connected with TX and RX pins of USART port in the controller. This communication between the devices takes place through RS-232 communication cable. The APR9600 IC and speaker are connected to the controller with 4 pins (RD4 to RD7). The audio file is recorded when RE=0 and replayed when RE=1 in the IC. This RFID based solution lend a hand to identify and purchase products in the supermarket [9].

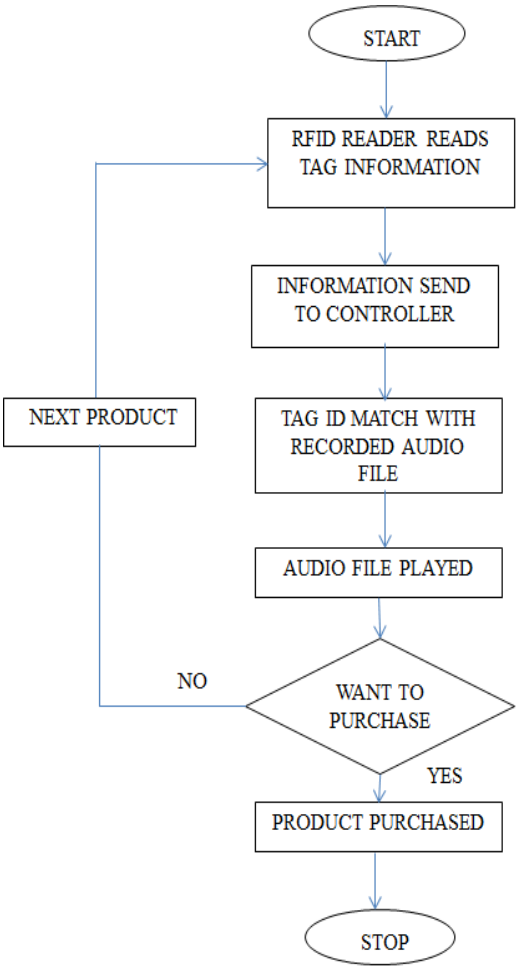

Fig. 3. System Flowchart

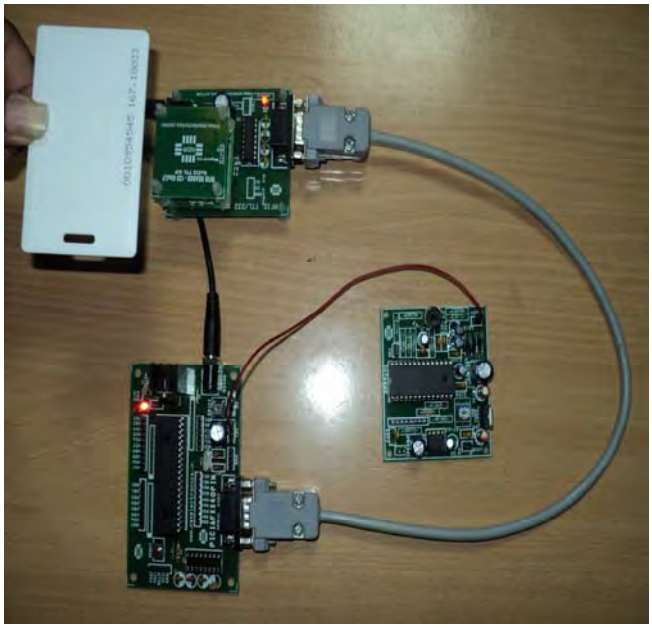

Fig. 4. Hardware model

V. TEST BENCH

Fig. 5, 6, 7 shows the products in the supermarket by reading each RFID tag ID based on the information stored in the audio file. These results are simulated by using ISIS Professional (PROTEUS Design Suite) software.

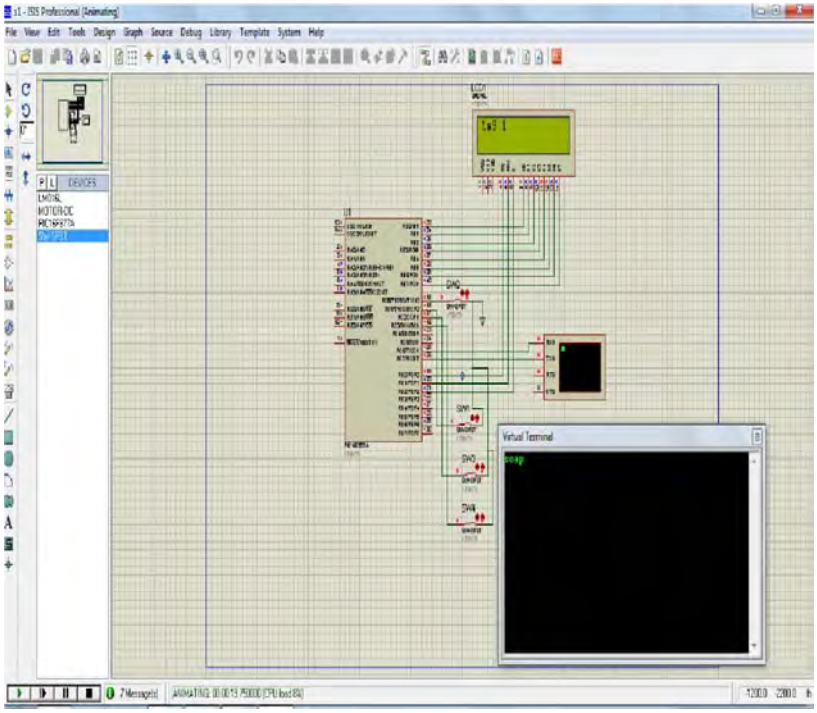

Fig. 5. Output of Tag 1

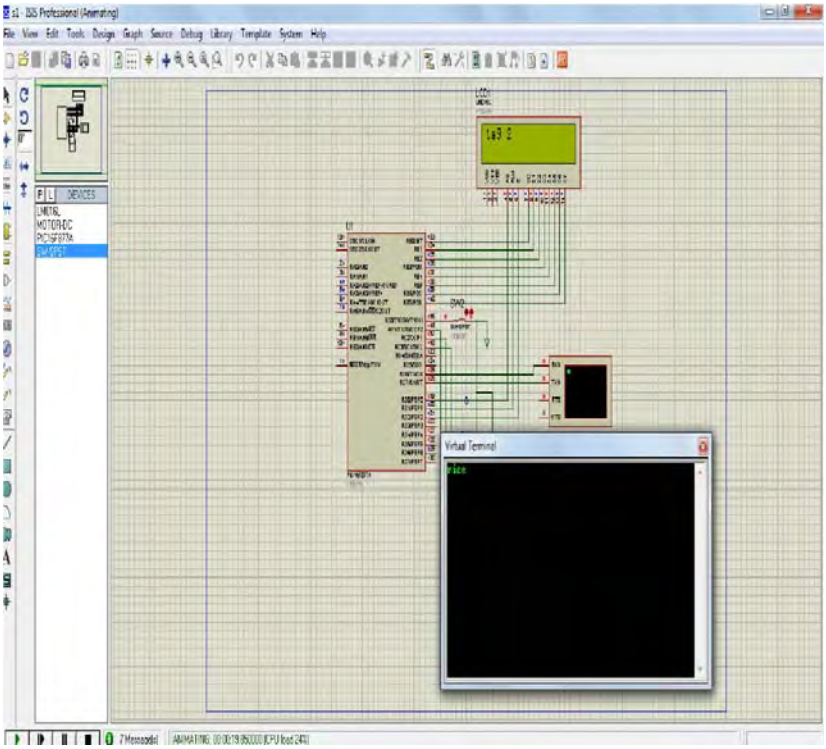

Fig. 6. Output of Tag 2

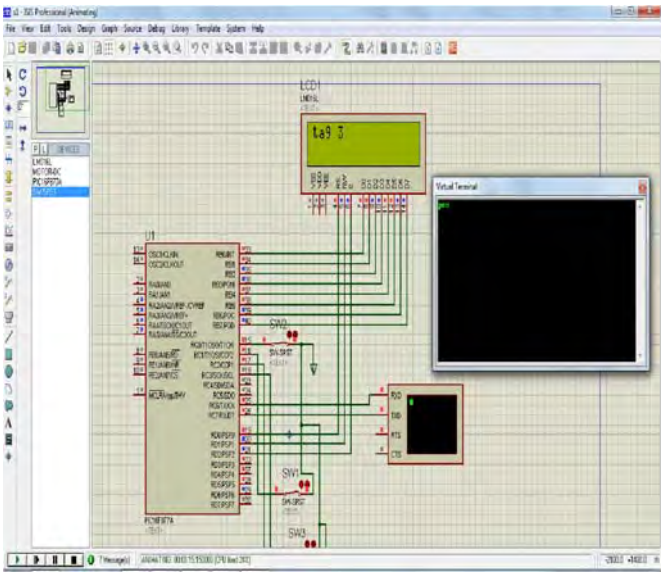

Fig. 7. Output of Tag 3

V. CONCLUSION

The proposed system provides greater guidance for the visually impaired people to satisfy their purchasing needs on their own. It facilitates the shopping and improving the life style of them. The system efficiency can be increased with the help of PIC microcontroller and RFID technology. This is portable, handheld system with affordable cost. It promotes the sales of the supermarket and giving the confidence for the visually impaired while purchasing. On implementing this system the shopping dream of visually impaired people becomes true. We are currently working to develop the system more reliable and flexible. In future the system will be integrated with Xbee/Zigbee interface card to build the supermarket billing system in an automated way.

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