ESHAIKH ABDALLAH ELBADRY UNIVERSITY
FacuLty of Engineering
Dep of Electrical Engineering

Design and Simulation of a product Recognition Device for Visually Impaired

A Research Submitted in partial filfillment for requirement of the degree B.Sc.(Honors) in Electerical Engineering

Prepared By:

Mohammed Sidahmed Mokhtar Sidahmed

Abuelgasim Fathi Abdelrahim Mohmed

Samah Hesain Alderdery Galal

Supervisor:
Emad Eldeen Elgaali ABD Elgafar Ali

Nov 2018

Dedication

I commit this venture to God Almighty my maker, my solid column, my wellspring of motivation, astuteness, information and comprehension. He has been the wellspring of my quality all through this program and on His wings just have I took off. I likewise commit this examination tenderly to the mum and father .

Acknowledgements

I have taken my endeavors to finish this venture. Nonetheless, it would be outlandish for me to finish this venture without the consolation and support from specific individuals. Subsequently, at here I might want to give my genuine because of every one of them. Above all else, I might want to on account of my boss, A.Emad Eldeen Elgaali Abd Elgafar Ali for giving information and steady supervision all through the venture. His direction, inspiration and exhorting on the venture has helped me finish the venture. Furthermore, I might want to demonstrate my appreciation to my family. Their support and consolation have roused me to complete this venture. Also, I might want to thank my folks to be comprehended amid the venture improvement time. Ultimately, I might want on account of my companions that imparting their insight to me while doing the venture. Their counselor has helped me to take care of the issues confronted in the venture.

Abstract

In live people very much depend on the senses and limb to do their activates, but there is many people who lost one or more from these sense and with it the ability to do a lot of thing by their own, One of the most important sense is the sight. In this time, there are many devices and technologies designed to help people with visually impaired overcome their difficulties, and shopping is one it. This project present a system to help visually impaired move freely in the supermarket and recognize the products. The recognition done by device carried by the visually impaired, the device contain a reader read the tags spread on the supermarket shelves, and each tag represent a product. The tags contain codes send to the reader and the send to voice chip, which play voice record, contain information about the product.

Abstract

Insert your arabic abstract

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ISD	Voice Record/playback device
RFID	Radio Frequency Identification
UMPC	Ultra Mobile Personal Computer
GPRS	General Packet Radio Service
WIFI	Wireless Fidelity
GPS	Global Positioning System
USB	Universal Serial Bus
EEP-ROM	Electrically Erasable Programmable Read Only
RISC	reduced instruction set computer
UART	Universal A synchronous Receiver and Transmitter
ICSP	In-Circuit Serial Programming
PCB	Printed Circuit Board
ID	Identifier
RF	Radio Frequency
IC	Integrated Circuit

1 Chapter One: Introduction

1.1 Overview

In recent year, shopping become a very hard task to do ,withhundreds manufactures and millions products ,supermarkets start beingbigger and contain thousands of products . The shopping trip started taking long time from theshopper to choose which manufacturer is thebest , which product is the right one and the healthiest by noticing thing like production date , expired date and product ingredients .with all things mention , shopping for every day needs become complicated fornormally people and much complicated for people with and kind of impaired.Many people with visually impaired shopping dependently. They receive assistance from a friend , a relative , an agency volunteer , or a store employee .Depending on the assistant availability , the shopper many need to postpone the shopping trip times .Instead of this , another solution for these people will be presented to make theirlife easier . This solution is a mobile device that helps the visually impaired to identify the products in the supermarket The supermarket presents the device to the visually impaired person when entering the supermarket . They use the device to identify any product in it . Every shelf in the supermarket have tags for every product , every tag contain a code , which is unique for each product . The device which carried by the visually impaired hasa reader can read those tags in specific shelve , and compare any tag code in shelf with all shelves tags codes which are savedin the supermarket data base.Each product specification like name , price , manufacturer and weight recorded by a very clear

voice and saved in the data base. When the device reads a specific tag , the system will recognize the product according to that tag , thus the core's ponding voice file will be played and the visually impaired will heart product information which exists on that shelve [1]

1.2 Problem statement

Visually impaired people face many problems in theirlife ,they need a lot of outside support in doing anything . oneof their problem is purchasing products from supermarket .This part of the visually impaired problems discussed andcovered in this project.

1.3 Proposed solution

To design a mobile device carried by visually impairedwhen getting inside the supermarket to describe the categoryof the product and its specification in the visually impaired section.

1.4 Objectives

The main objectives of the project are:

1. To design a guiding system using infrared technology to guide-the visually impaired inside the supermarket.
2. To design a visually impaired product identification device using RFID and microcontroller technologies.
3. To simulate the suggested design of the guiding system by using protest simulation environment.
4. To simulate the suggested design of the device by using protest simulation environment.

5. To implement a proto type of the proposed system

1.5 Methodology

When this project start, the first phase was todetermine the objective of the project, the technologies thatcan use to achieve this objectives , and to decide whichtechnology is the best to work with. The second phase was todescribe the problems that visually impaired facing inshopping , this done by asking people with visually impairedand read researches describe all the problems . After this ,some exploring is done revealing some old research in thesame area using different techniques and ideas , which washelpful in writing literature review , adding new ideas to theproject and showing the point the project need to focus on. The third phase start with writing the scenario , from themoment that the visually impaired enter the supermarket ,movement inside the supermarket , way to recognize the product using the device and until leaving the supermarket.Then drawing the device block diagram , and end withsimulate the device and guiding system work . The fourth phase was to build hardware proto type which containat mega16 microcontroller , radio frequency identification RFID reader and tags , audio recorder chip ISD 1820 AND Head phone.

1.6 Thesis organization

This Research consist five Chapter . Chapter one consists of preface , problem statement, proposed solution , objectives and methodology. Chapter two provides the background and literature reviewChapter three consists of the device and the guiding systemblock diagrams ,information about the component functionin the system.Chapter four contains the simulation of the device and results. Chapter five consists of the conclusion of the project and the reference.

2 Chapter Two: Background and Literature Review

2.1 Background

For many years in the beginning of time visually impaired people was isolated from society, and treated as burden on their families. However, in the recent century people try to help them interact with the society and depend on their own. One of the most signifies field is making the visually impaired shopping independently for their grocery. One of the main problems facing them in the shopping is the guiding problem, how the visually impaired will know his/her way from the house to the supermarket and vice versa, and how they know their way inside the super market and where they will find their desire products. The other problem is how they recognize this products, some of them was using the smell of the fruits and vegetable to distinguish between it. One of techniques that help visually impaired in shopping is by going with another person to help him/her purchasing their products. The good thing about this technique that the visually impaired can choose the product personally and can find the alternative if the visually impaired did not find the product. The problem with this technique that these people may not be available at any time. Other technique that help visually impaired in shopping is home delivery shopping. The visually impaired call the supermarket and give the supermarket list of the products that he/she need, and then supermarket employee deliver the products to the visually impaired in the house. The advantage

of this technique is that the visually impaired do not need to go to the supermarket. The disadvantage of this method is that the visually impaired until delivery employee arrived [1].
In modern century, many techniques used to help the visually impaired in shopping independently, these techniques design to guide the visually impaired inside the supermarket and recognize the products. [2] .

2.1.1 Related Work

Robocart in [3], developed by Utah State University, gave place to a robotic supermarket assistant, in the form of a custom-built market cart equipped with a laptop, a laser range finder, and an RFID reader. For navigation, it uses the RFID reader attached to the cart and passive RFID tags scattered at different points in a supermarket. Furthermore, a wireless barcode scanner is used for product search and identification. The biggest drawback of this system, in contrast with BlindShopping, is its use of additional nonconventional costly and complex to manage devices.
The same research group developed ShopTalk [4], an alternative more wearable solution. In this case, it requires that the user carries a barcode scanner and a UltraMobile Personal Computer (UMPC) in a backpack. A barcode scanner aided with two plastic stabilisers to enhance usability is used to read barcodes placed in product shelves. Verbal route instructions were issued through a headphone connected to the UMPC at the blind person's backpack. Although the supermarket does not need to install and maintain any hardware, the system requires access to the supermarket's inventory control system. In contrast, BlindShopping only requires blind users to carry a lightweight smartphone equipped with a camera to read [2] codes attached to product shelves and to navigate through the supermarket with the aid of a white cane augmented with an RFID reader at its tip.

Another interesting assisted shopping solution is GroZi [5], which focuses on using computer vision software for detecting products. Visually-impaired people use a hand glove with a small camera and vibrating motors that provide haptic feedback. A small wearable device carries out image processing and generates haptic feedback in the two dimensional plane of the shelf for product localization and verbal feedback for identified product description. Again, BlindShopping is more easily deployable, economically and technically, since it uses a "common" device such as a smartphone and the standard white cane used for guidance.
Tinetra in [6] presented at Carnegie Mellon University, offers the possibility of detecting products via a barcode or RFID reader, and then it obtains related information via GPRS from the server. However, it does not include a guiding system as BlindShopping. Interestingly, the system advocates, as in BlindShopping case, a mobile platform for accessible blind shopping. It handles both barcodes and RFID tags. Similarly to us they use a Baracode Pencil2 and a Baracoda IDBlue to scan barcodes and RFID tags, respectively. iCare in [7] relies on an RFID reader embedded in a hand glove to detect products and query information from a server via Wi-Fi. The user has to move her hand along the shelf, so the system gives indications such as "passing dairy section". This system seems more intrusive than ours, where the user still uses her white cane, enhanced with an RFID reader. The usage of RFID is very promising, but it presents problems from the technical and industrial side. Tags attached to liquid low-end products with metal cases refract and reflect RF waves. Manufacturing costs for tags and readers remain prohibitive for tagging all but high-value products. Technical problems, environmental hazards and consumer perceptions of trust, privacy and risk, mixed with fear remain significant acceptance barriers to RFID item-level tagging.

2.2 Contributions

Helps the blind to move in the supermarket and facilitate the process of selection of the product and facilitate the process .

2.3 Summary

This work has shown a low-cost easily deployable solution for blind people assisted shopping constituted of two main components, an RFID and mobile phone based indoornavigation system and a mobile code based product recognizer. It is important to note that although the chosen scenario was a supermarket, the platform can be easily adapted to any other self-service shopping scenario. Further work will expand the BlindShopping Android mobile application with GPS reading capabilities, so as to guide the user from her home to the supermarket. Although the RFID reader has been implemented with a Nokia as a proof of concept, it will soon be replaced by a dedicated Bluetooth RFID reader. A fully fledge evaluation in a real supermarket carried out by a statistically significant group of blind people will also be carried out to thoroughly assess the suitability of the proposed solution.

3 Chapter three:System Implementation

3.1 Introduction

This chapter will focus on the discussion on the project flow and the method to implement this project , Hardware devices will This system .
The system of Fixed and mobility embedded system mainly has two parts, throgh which the blind RFID READER is equipped by a device known as ,mobility ,which is located in RFID TAG scans the cards that are in the system of the -called the supermarket and after Arduino treatment of these signals ,which also is used to obtain the names of ISD1820 strengthens the sound recorder that knows the product name ,each on its own, according to the sound recorder that knows the product name ,each on own, according to the entry code for the cards, and thus the name of the products is disclosed to the blind .

3.2 Project Overview

This Project Consists mainly of two parts ,hardware design and software the design. The hardware dsign cosists of four main part Arduino UNO is Used as an accurate controller for the built -in sysetem .RFID TAGE contains code. RFID RWADER scans the card to read the product. Each product has a certain code with a voice that extracts that produt sound

3.3 Project flow chart

Figure 3.2 shows the method and design throughout the project. The literature review and documentation will be kept updated throught the project. For hardware and software implementation, testing.

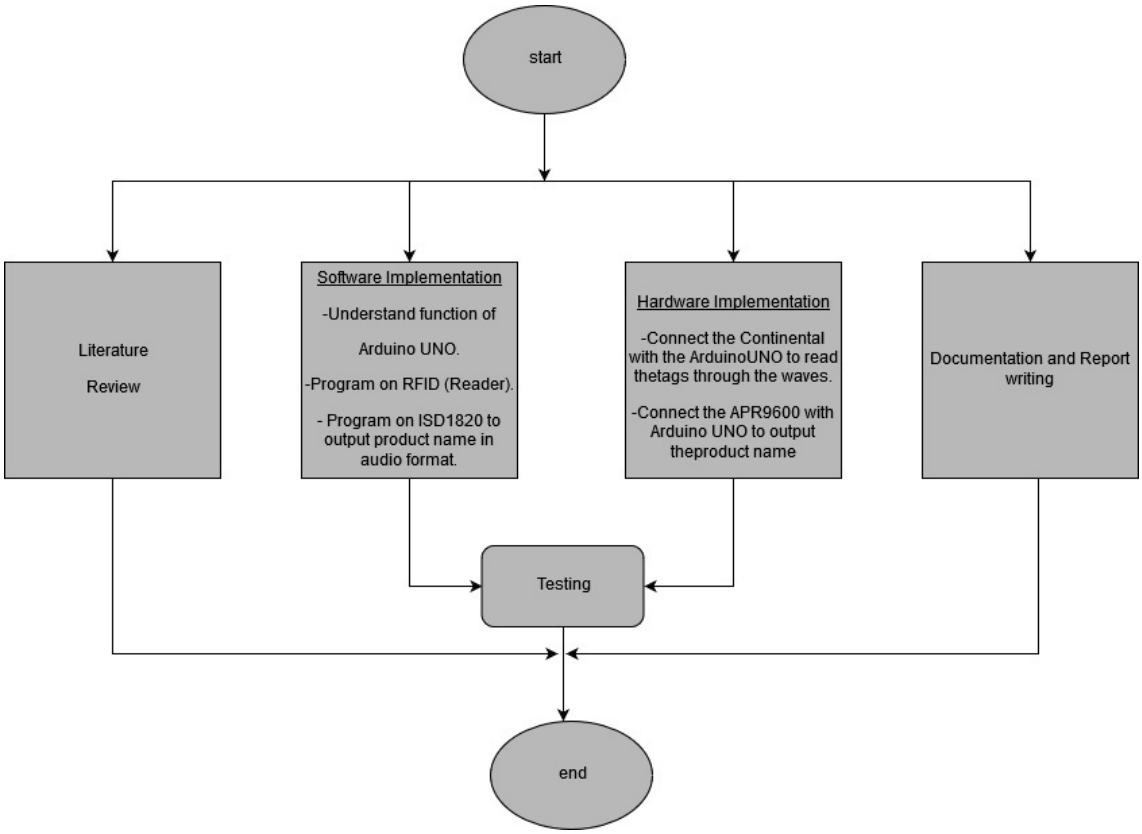

Figure 3.1: Flow of project

3.4 The Proposed System

This proposed system allows visually impaired people to identify product in the supermarket. This section include block diagram represent how component connected and each component specific job . The Proposed System This proposed system allows visually impaired people to identify product in the supermarket. This section include block diagram represent how component connected and each component specific job .The block diagram of our proposed system, as shown in figure 3.2, consists of eight blocks

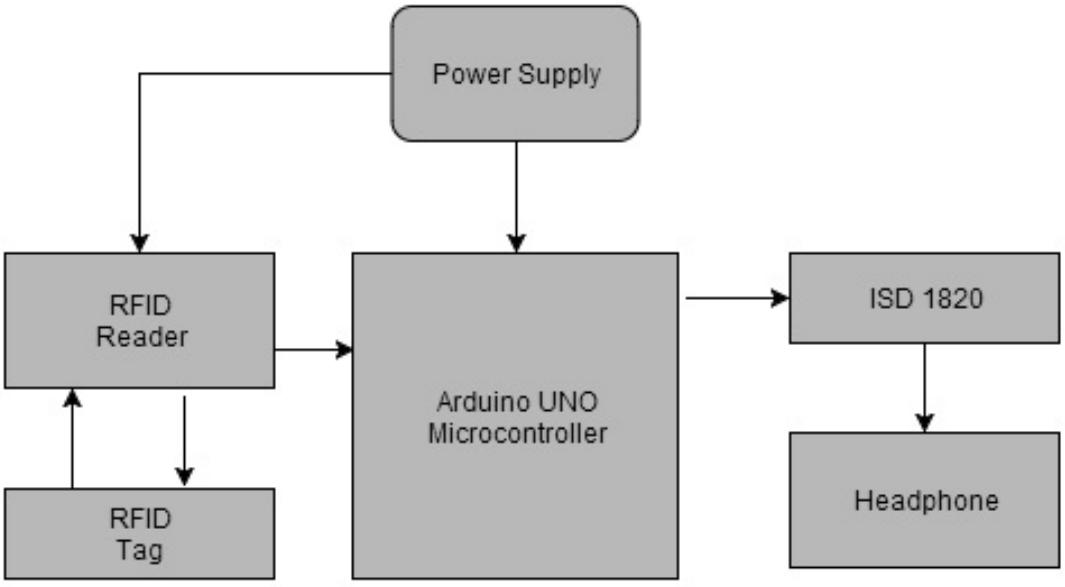

Figure 3.2: System block diagram

3.5 Materials

3.5.1 Microcontroller

Microcontroller is built by a single integrated circuit. it consists of proces-sor core,memory and programmable input and output peripherals,Figure 3.4 shows the overall operation system in a microcontroller.

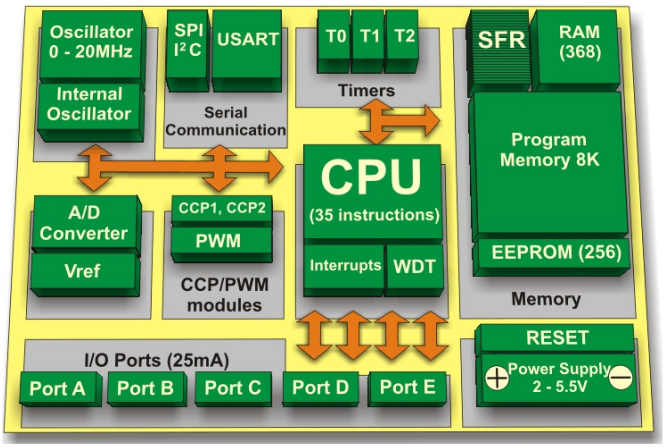

Figure 3.3: Microcontroller architecture [6]

3.5.2 Arduino UNO

Arduino UNO is the microcontroller that is used in this project. It is built based on ATmega328 in AVR 8 bit RISC architecture. It has 6 analog inputs, 14 digital input output port, a USB connection, 16MHz ceramic resonator, power jack and an ICSP connector. It consists of 1 KB of EEPROM memory which can be read and writen. Communication in Arduino UNO is using UART TTL serial communication [2]. Figure 3.5 shows the input and output ports and features that are built in the Arduino Uno.[6].

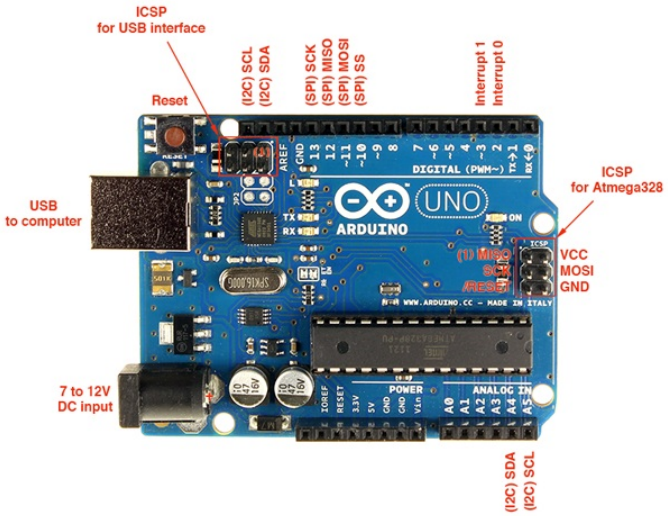

Figure 3.4: Arduino UNO R3 pinouts

3.5.2.1 Advantages Arduino

1. Ready to Use: The biggest advantage of Arduino is its ready to use structure. As Arduino comes in a complete package form which includes the 5V regulator, a burner, an oscillator, a micro-controller, serial communication interface, LED and headers for the connections. You don't have to think about programmer connections for programming or any other interface.

2. Examples of codes: Another big advantage of Arduino is its library of examples present inside the software of Arduino.

3. Simple, clear programming environmentOpen source- Simplified and user-friendly programming language- Portable- Low power consumption.

4. Effortless functions: During coding of Arduino, you will notice some functions which make the life so easy. Another advantage of Arduino is its automatic unit conversion capability.

5. Large community: There are many forums present on the internet in which people are talking about the Arduino. Engineers, hobbyists and professionals are making their projects through Arduino. You can easily find help about everything. Moreover the Arduino website itself explains each and every functions of Arduino [6].

3.5.2.2 Arduino Disadvantages

1. Structure: Yes, the structure of Arduino is its disadvantage as well. During building a project you have to make its size as small as possible. But with the big structures of Arduino we have to stick with big sized PCB's. If you are working on a small micro-controller like ATmega8 you can easily make your PCB as small as possible.

2. Cost: The most important factor which you cannot deny is cost. This is the problem which every hobbyist, Engineer or Professional has to face. Now, we must consider that the Arduino is cost effective or not..

3. Open source- Simplified and user-friendly programming language- Portable- Low power consumption .

3.5.3 RFID TAG

RFID tagging is an ID system for identification and tracking purposes that uses radio frequency identification devices. An RFID

tagging system consists of the tag, a read/write or only read device, and a system application for data collection, processing, and transmission. RFID tags consist of minimum two parts: an integrated circuit and an antenna for receiving and transmitting the signal. The tag information is stored a non-volatile memory, Figure 3.5 shows the Reader with tag.

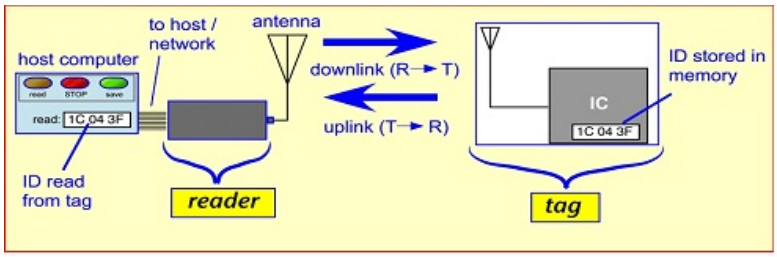

Figure 3.5: Reader with tag

3.5.3.1 Types FRID Tags

RFID tags that include power source are known as active tags versus those without a power source which are passive tags. A passive tag is activated momentarily by the radio frequency (RF) scan of the reader. The electrical current is just enough for transmission of an ID number. Abracon's RFID Tag series includes variety of passive ceramic tags without chip which have to be matched with a compatible IC to be utilized.A comparative survey is achieved and given in Table 3.1

3.5.3.2 RFID System Applications

Some of the many applications of RFID tagging are as following Supply chain management In fast paste manufacturing shipping, and distribution environments, RFID tagging can provide real-time data on the status of individual items. Unlike bar code stickers, RFID tags don't require line-of sight between the tag and the reader. Materia Management In large scale construction projects, material

Table 3.1: Table 3.1: General a comparative of some sensor)

	ACTIVE RFID	PASSIVE RFID
Advantages	Reads long distance Higher data bandwidth Iniciates Communications	Tag's function doesn't rely on battery Inexpensive Variety in size including small sizes More resistant to damage and harsh environments
Disadvantages	Expensive Can't function without battery Large in size ,not for small applications	Communication depends on antenna size and shape Read range is limited Difficulty reading through metal or liquid

management is often the largest project expense. RFID tracking system can significantly reduce search related expenses and time. Gas and oil drilling and pipeline management . Toll collection and contactless pay me.

3.5.4 ISD1820 Voice Recorder

3.5.4.1 Introduction

Voice Record Module is base on ISD1820, which a multiple-message record/playback device. It can offers true single-chip voice recording, no-volatile storage, and playback capability for 8 to 20 seconds. The sample is 3.2k and the total 20s for the Recorder. This module use is very easy which you could direct control by push button on board or by Microcontroller such as Arduino, STM32, ChipKit etc. Frome these, you can easy control record , playback and repeat and so on.

3.5.4.2 Feature

1. Push-button interface, playback can be edge or level activated.

2. Automatic power-dwon mode.
3. Onchip 8 ohm speaker driver.
4. Signal 3V Power Supply.
5. Can be controlled both manually or by MCU.
6. Sample rate and duration changable by replacing a single resistor. -
7. Record up to 20 seconds of audio.
8. Dimensions: 37 x 54 mm.

3.5.4.3 Application

Typical schematic list as follows.If you want change record duration, an external resistor is necessary to select the record duration and sampling frequency, which can range from 8 – 20 seconds (4-12kHz sampling frequency). The Voice Record Module of our provide default connect 100k resistor by short cap. So the default record duration is 10s.

1. VCC– 3.3V power supply
2. GND– Power ground
3. REC – The REC input is an active-HIGH record signal. The module starts recording whenever REC is HIGH. This pin must remain HIGH for the duration of the recording.REC takes precedence over either playback (PLAYL or PLAYE) signal.
4. PLAYE – Playback, Edge-activated: When a HIGH-going transition is detected on continues until an End-of-Message (EOM) marker is encountered or the end of the memory space is reached.
5. PLAYL – Playback, Level-activated, when this input pin level transits for LOW to HIGH, a playback cycle is initiated.

6. Speaker Outputs – The SP+ and SP- pins provide direct drive for loudspeakers with impedances as low as 8 ohm.

7. MIC – Microphone Input, the microphone input transfers its signals to the on-chip preamplifier.

8. FT – Feed Through: This mode enable the Microphone to drive the speaker directly.

9. P-E – Play the records endlessly.

3.5.4.4 Record Operate Guide

1. Push REC button then the RECLED will light and keep push until record end.

2. Release the REC button.

3. Select Playback mode: PLAYE, just need push one time, and will playback all of the record or power down ; PLAYL, you need always push this button until you want to stop playback record or end ; When short P-E jumper the record will playback time a time until jumper off or power down.

4. FT mode, when short FT jumper, that means all of you speak to MIC will direct playbackto Speaker.

3.5.5 Power Amplifier Circuit

If you want extern power amplifier circuit to Speakers, you can use LM386, D2283, D2322, TA7368, MC34119 etc amplifier IC. Note, SP+ or SP- is you do not want to use, must vacant, do not connect to GND.

4 Chapter four:Implementations, Simulations and Results

4.1 Introduction

In this chapter , the results of this project are discussed . The results are tested and verified in order to ensure the function of the project fulfills the objectives.

4.2 The Product requirements

The recognition subsystem contain the passive tags, which place on the shelves with the products and the reader, which carried by the VI. The system start when the VI arrive to tag place and operate the reader then the reader send signal to energize the passive tag. Then the tag will send code back to the reader, after the reader receive the code it sent to the arduino. The arduino will use the code to compare it with set of code saved in it and when it found it, the audio file which attachedto the code will sent to the ISD 1820 . The ISD 1820 will play the audio file to the VI who will heard it throw headphone attached to the device .REC is pressed to record the sound and the key is pressed on the length of the recording time and after the stop recording .Figure 4.1 shows the ISD 1820 module.

Figure 4.1: ISD 1820

4.3 Testing For system

figure 4-2 show press the REC button to register the product name is the name that was extracted by the ISD1820 audio chip and in this way allows the bling to identify the product.

figure 4-3 show the recording was stopped and the word was saved and entered into the card. It was connected to a card and when the card was passed ,the sound recorded by the ISD 1820. figure 4-5 when the card is passed , the previously recorded word is spoken. figure 4-6 show when the card was passed on the continental product name was pronounced by the sound chip.

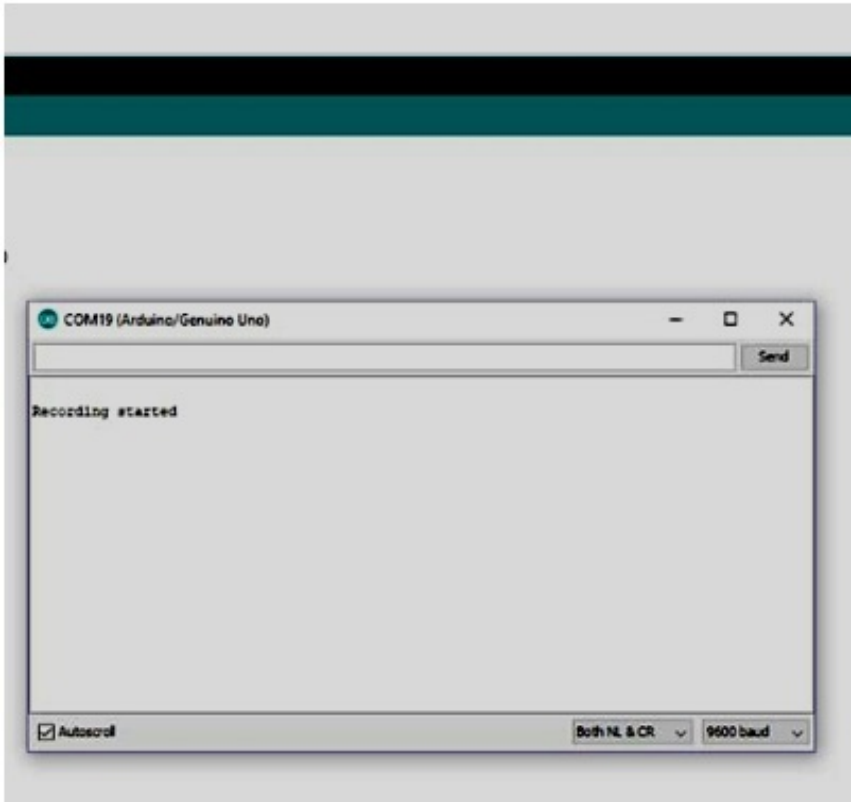

Figure 4.2: The REC key is pressed to record the sound

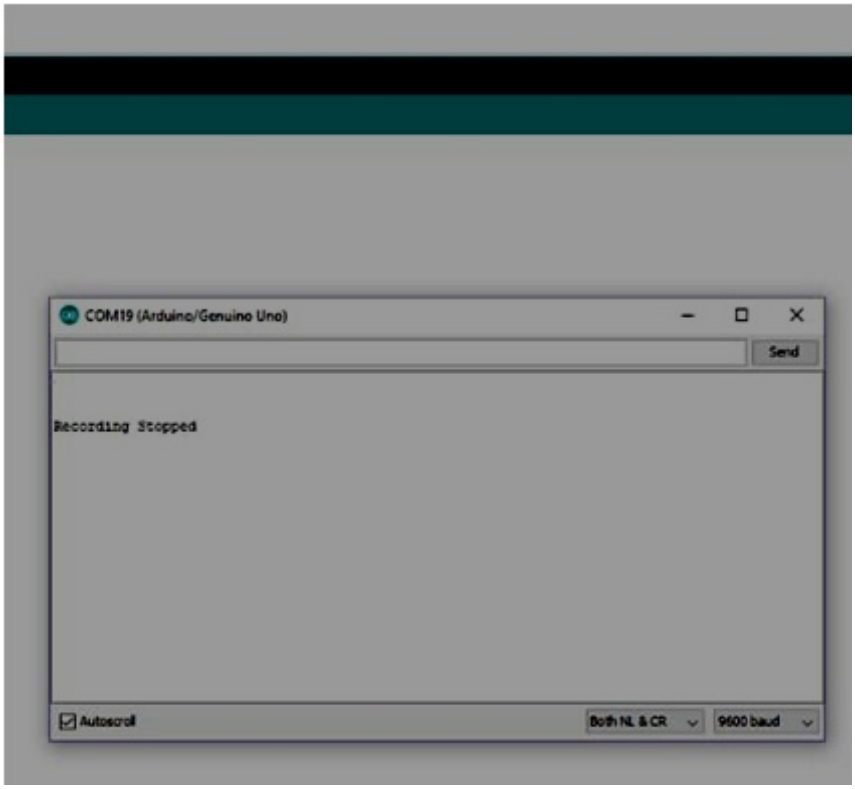

Figure 4.3: stop the recording

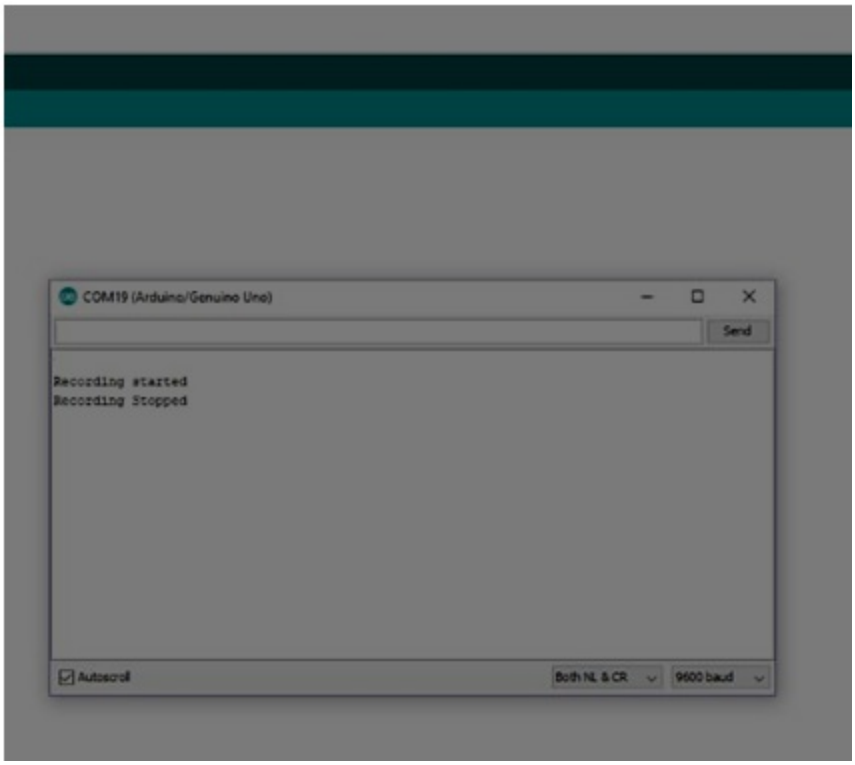

Figure 4.4: start and stop recording

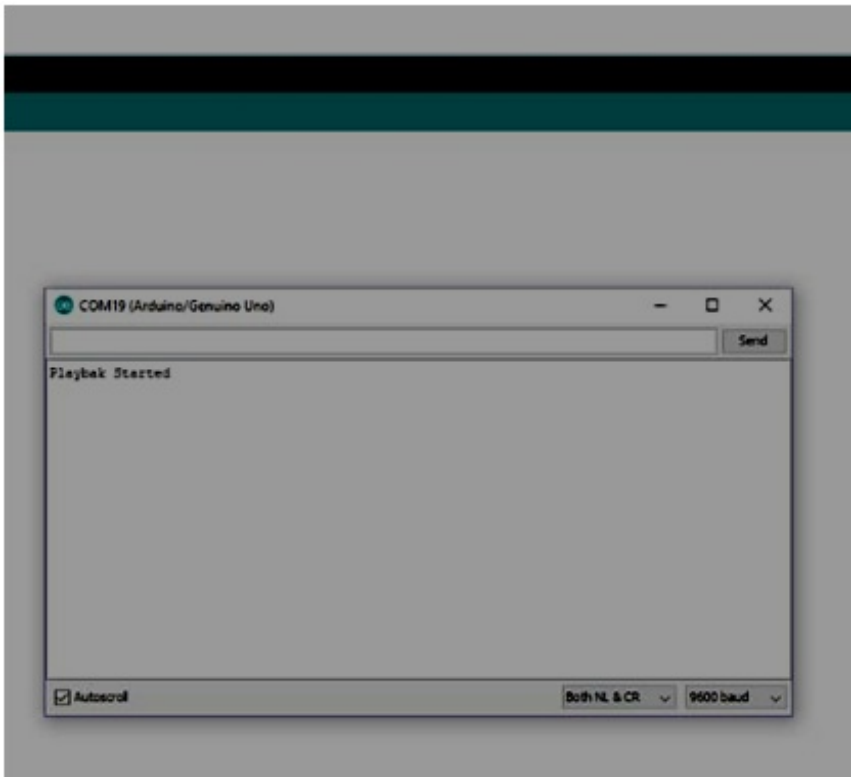

Figure 4.5: playbak started

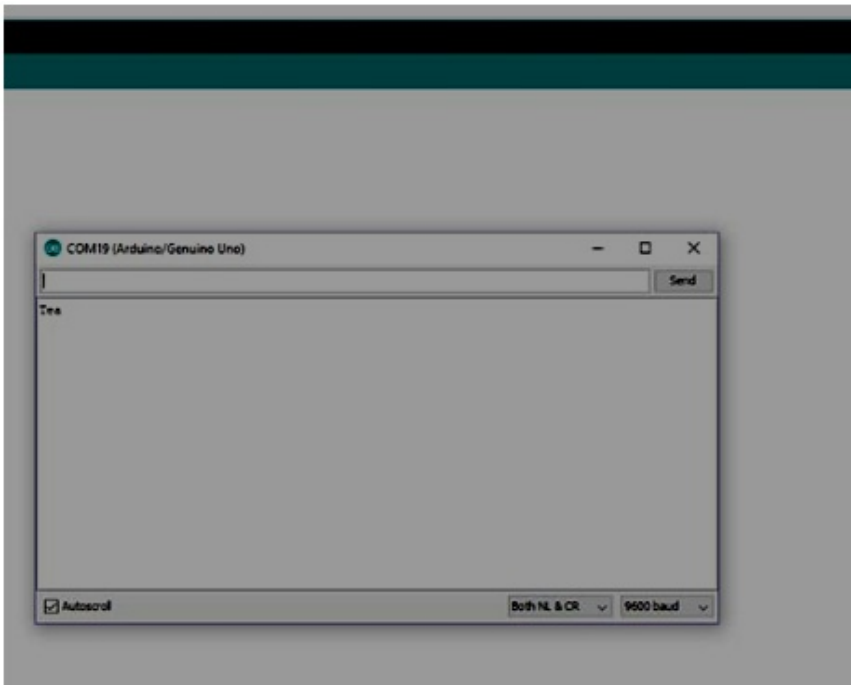

Figure 4.6: read the product name

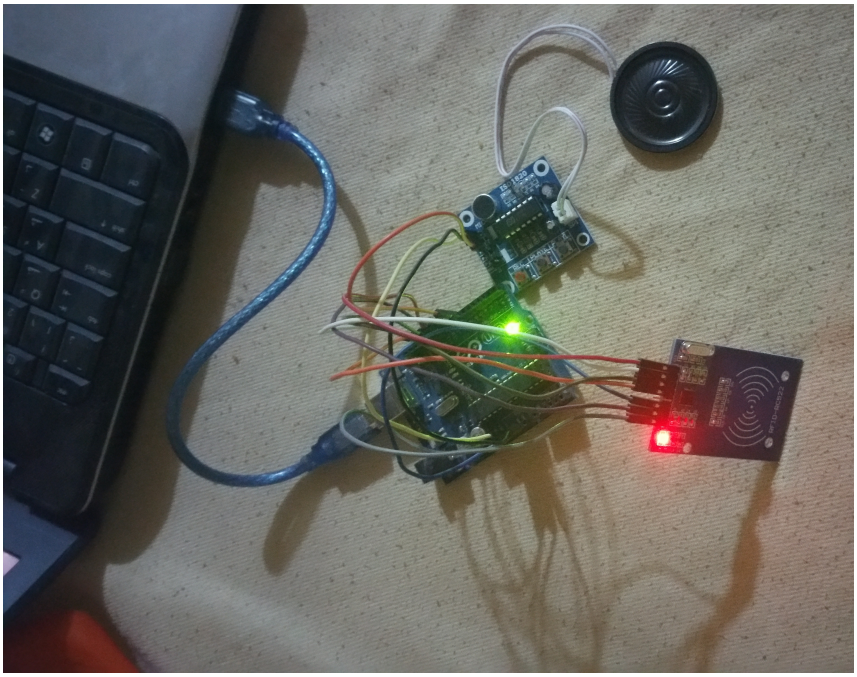

Figure 4.7: hardware desgin of project

Figure 4.8: desgin of project

Figure 4.9: desgin of project

4.4 Summary

In this chapter ,we put the cards on the reader ,The monitor of The Arduino screen and then we allocated two cards, one for recording the sound and the other recording play back.

5 Chapter Five: Conclusions and Recommendations

5.1 Conclusions

The system is very innovative, practically useful for the visually impaired people and realized as a prototype. By using this fully automated product, they can stand on their own at the time of shopping. It does not need more skills to operate, overcomes the hesitation and giving confidence for purchasing their shopping needs. With the help of RFID readers and tags, visually impaired people can get to know the product information easily. The proposed system effectively implemented by using Arduino Uno for providing simplicity and efficiency. It makes the better use of RFID and ISD1820 technologies for providing the smart environment for visually impaired. To avoid collision among the blind people and for obstacle detection, pressing sensors (guiding system) will be mounted in the lane of the supermarket ground. This system is implementing with affordable cost. On implementing this system the shopping dream of visually impaired people becomes true.

5.2 Recommendations

This project discusses the design and implementation of smart super market system for visually impaired. To increase the efficiency of this project. It's recommended to consider the following points:

1. For more efficiency it's recommended to integrate GPS system to this project or make it including the scenario of guiding the visually impaired to supermarket reception again.

2. For large supermarkets it's recommended to use a voice module with larger memory or use external memory.

3. To minimize the size of the circuit and somehow the cost it's recommended to use At mega 16 microcontroller, small RFID reader and small voice chip.

4. To develop the design and implementation of a product recognize device for visually impaired its recommended to integrate the device with the Electronic Blind Stick.

5. To design a guiding system using infrared technology to guide the visually impaired inside the supermarket.

Bibliography

[1] R. Chen, L. Peng, and Y. Qin, "Supermarket shopping guide system based on internet of things," 2010.

[2] V. Kulyukin and A. Kutiyanawala, "Accessible shopping systems for blind and visually impaired individuals: Design requirements and the state of the art," *The Open Rehabilitation Journal*, vol. 3, pp. 158–168, 2010.

[3] J. Nicholson, V. Kulyukin, and D. Coster, "Shoptalk: independent blind shopping through verbal route directions and barcode scans," *The Open Rehabilitation Journal*, vol. 2, no. 1, pp. 11–23, 2009.

[4] M. Merler, C. Galleguillos, and S. Belongie, "Recognizing groceries in situ using in vitro training data," in *Computer Vision and Pattern Recognition, 2007. CVPR'07. IEEE Conference on*. IEEE, 2007, pp. 1–8.

[5] P. E. Lanigan, A. M. Paulos, A. W. Williams, D. Rossi, and P. Narasimhan, "Trinetra: Assistive technologies for grocery shopping for the blind." in *ISWC*, 2006, pp. 147–148.

[6] S. Krishna, V. Balasubramanian, N. Krishnan, T. Hedgpeth, and S. Panchanathan, "The icare ambient interactive shopping environment," in *23rd Annual International Technology and Persons with Disabilities Conference (CSUN), Los Angeles, CA*, 2008.

[7] M. H. A. Wahab, A. A. Talib, H. A. Kadir, A. Johari, A. Noraziah,

R. M. Sidek, and A. A. Mutalib, "Smart cane: Assistive cane for visually-impaired people," *arXiv preprint arXiv:1110.5156*, 2011.

Appendix A

1 Program 1....

```
1
2  #include "SPI.h"
3  #include "MFRC522.h"
4
5  #define SS_PIN 10
6  #define RST_PIN 9
7  #define SP_PIN 8
8
9  #define product1 2
10 #define product2 3
11 #define product3 4
12 #define product4 5
13
14 MFRC522 rfid(SS_PIN, RST_PIN);
15
16 MFRC522::MIFARE_Key key;
17
18 void setup() {
19   Serial.begin(9600);
20   //pinMode(led, OUTPUT);
21   SPI.begin();
22   rfid.PCD_Init();
23 }
24
25 void loop() {
26   if (!rfid.PICC_IsNewCardPresent() || !rfid.PICC_ReadCardSerial())
27     return;
28
29   // Serial.print(F("PICC type: "));
30   MFRC522::PICC_Type piccType = rfid.PICC_GetType(rfid.uid.sak);
31   // Serial.println(rfid.PICC_GetTypeName(piccType));
32
```

```
33   // Check is the PICC of Classic MIFARE type
34   if (piccType != MFRC522::PICC_TYPE_MIFARE_MINI &&
35     piccType != MFRC522::PICC_TYPE_MIFARE_1K &&
36     piccType != MFRC522::PICC_TYPE_MIFARE_4K) {
37     Serial.println(F("Your tag is not of type MIFARE Classic."));
38     return;
39   }
40
41   String strID = "";
42   for (byte i = 0; i < 4; i++) {
43     strID +=
44     (rfid.uid.uidByte[i] < 0x10 ? "0" : "") +
45     String(rfid.uid.uidByte[i], HEX) +
46     (i!=3 ? ":" : "");
47   }
48   strID.toUpperCase();
49
50   //                                                    ...
                           strID                                  UID ...

51   // ...
                                                                          ...
                                              IF ...

52   // LED
53   //Serial.print("Tap card key: ");
54   //Serial.println(strID);
55   if (strID== "D9:7A:53:24")
56    {
57     Serial.println("Milk");
58    }
59    else if (strID== "04:A6:9C:39")
60   {
61   Serial.println("Tea");
62
63   }
64    else if (strID== "14:94:9A:39")
65   {
66   Serial.println("Cofee");
67   }
68    else if (strID== "DC:14:A0:59")
69   {
70   Serial.println("Water");
71   }
72   else {
73     Serial.println("product's not found");
```

```
74    }
75    rfid.PICC_HaltA();
76    rfid.PCD_StopCrypto1();
77  }
```