UNIVERSITY OF MUMBAI

A PROJECT REPORT ON

Wireless Shopping Assistant for the Visually Impaired

BACHELOR OF ENGINEERING

In

INFORMATION TECHNOLOGY

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ACKNOWLEDGEMENT

The satisfaction that accompanies the successful completion of any task would be incomplete without naming certain individuals who made it possible, whose constant diligence, supervision and encouragement made the work success.

We wish to express our sincere thanks to our Head of Department Prof. Dilip M. Dalgade for mentoring us and providing invaluable support. We would also like to express our cordial gratitude to Prof. Nilesh Patil, who guided us in this undertaking. We express our sincere thanks to all the other Professors who gave their valuable inputs and guided us at the various phases of the project.

We wish to mention the name of the laboratory assistant Mr. Santosh Ghatkar who let us use the hardware and software equipment in the labs for working on this project.

Last but not the least, we would like to acknowledge the contributions from our classmates who were always there when we needed them and whom we missed to acknowledge individually for their co-operation.

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Abstract

A Wireless Shopping Assistant for the Visually Impaired is a system designed to aid the blind or the sight impaired shopper in independently identifying and selecting products off the store shelf without the need of human assistance. It has been built up on the fact that although the sight impaired may lack full use of their visual senses, they still retain their functional tactile and auditory perceptions as their strengths.

We aim at developing a cost-effective assistive technology that would provide the visually impaired people with a higher degree of independence in their daily activities. Also, another purpose of this project is to improve the quality of life for the blind by harnessing the collective capability of diverse networked embedded devices to support shopping and empower the users with convenience and self-dependence.

Our project is a shopping assistant for the visually impaired, which is a device that makes use of Radio Frequency Identification Technology, Bluetooth connectivity and the concept of text to speech conversion, to make the user's shopping experience comparatively easier. This system acts as a translator, converting information designed to be collected by the eyes, into a format easily acquired by the ears, in an equitable and affordable manner.

We seek to address an important accessibility issue with low-cost RF-technology and ubiquitous computing.

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Chapter 1

Introduction

Different environments present different challenges to people with visual impairments. Some environments are challenging due to their large size or lack of structure, whereas other environments, although structurally regular, are functionally challenging due to the complexities of the tasks that must be performed in them. The list of the most functionally challenging environments for individuals with visual impairments is topped by shopping complexes. This difficulty can be understood given that a typical modern supermarket stocks an average of 45,000 products and has a median store size of 48,750 square feet. Many people with visual impairments do not shop independently. They receive assistance from a friend, a relative, an agency volunteer, or a store employee. Depending on the assistant's availability, the shopper may need to postpone the shopping trip. Accessibility of services and information is an important goal for modern technology. With the in- creased capabilities of computers and computing devices comes an increased responsibility to use this technology in assisting those whose quality of life could potentially be greatly improved. The project is designed to address one small portion of the larger issue, and seeks to aid the blind or the sight impaired shopper in independently identifying and selecting products off the store shelf without the need of human assistance.

The project provide to leverage what is expected to be standard industry practices labeling products with RFID tags, together with existing product database in order to address the problems faced by visually impaired people.

Chapter 2

Scope

Similar systems are already present in the world but they have their own negative aspects. Some of them require a human attendant to be employed for assisting the blind shopper, but doing this proves expensive as the attendant would not be required on a regular basis. Others serve a similar purpose, but they are bulky and heavy, which reduces convenience. They have a server which is device specific and requires individual updating whenever a new product is added or deducted from the inventory.

This device will help the blind people to be able to go about their daily activities, without requiring/requesting assistance from a sighted person would be invaluable. This device is light weighted and very convenient to use.

The proposed project is connected to single centralized server so any updating or modification needs to be done only on the server side and not on single devices.

It can be implemented very easily at various Supermarkets and Departmental stores who wish to switch from the conventional human-attendant system to this contraption.

Chapter 3

Literature Review

3.1 Past History

Systems constructed for the assistance of the visually impaired have been given a lot of importance in the past 10-12 years. Several electronics manufacturing companies have been researching on how blind people can benefit using modern technology and that takes advantages of their other senses viz. touch, hearing, etc. We referred to several papers while working on the project to seek help and learn from their conclusions, to attempt to make certain improvisations wherever possible.

Lingo Pal, a language tutoring system for young children. Lingo Pal consists of a Linux Ipaq, a handheld RFID reader, and RFID tags that map to objects, like chairs and tables, in the child's environment. The child can use LingoPal to read the tags that are attached to these objects and have the spelling and pronunciation of the objects' names appear.

MSR Aura (Advanced User Resource Annotation) is a project that came out of Microsoft Research. AURA is a wireless system for digitally identifying and annotating physical objects, and for sharing these annotations. Currently they have implemented this using and Ipaq attached to a barcode scanner and a WiFi network and are working on extending this with RFID technology. The user scans a product and the system will look through the internet for related pages.

I.D. Mate is a talking barcode scanner. It is a portable, electronic device that scans barcodes and labels of various items at the grocery store. On board the device is a UPC database of almost 1 million items to enable the identification of scanned items ID. Mate also allows voice messages to be recorded and associated with any scanned item, in case the user wishes to recall important information.

3.2 Problem Definition

There are many kinds of food that can be identified by touch, such as fruits and vegetables. But grocery items like cans of soup, cereal boxes, canned vegetables, etc. may be harder to identify. A common problem for blind and visually impaired people is to differentiate between containers that feel the same but that have different contents. This is a much more serious problem if the products are hazardous, e.g., discriminating between a glue-stick and stick of lip balm.

Consider the following question posed by a blind person: ”Have you ever opened a can, hoping to add tomatoes to your spaghetti sauce, and then been faced with the dilemma of figuring out how to incorporate green beans into the menu?” The author of this article proposes the use of Braille as a way to identify various grocery items in order to work around this problem, using the combination of a Braille writer and labeling tape to affix custom labels onto purchased grocery items to mitigate the uncertainty in cooking and product usage. This solution has its clear advantages - it allows a blind user to create custom tags for various common items (beyond groceries, to include appliances and other household items) in order to allow for faster and more accurate identification at a later time, without requiring assistance from a sighted person at the time of identification. Unfortunately, there are two drawbacks: first, the assistance of a sighted person might still be required at the time of product-tagging in order to generate the correct Braille labels, and secondly, Braille literacy is still not widespread (only 8-10), as described above) in the blind community. Also, it is not economically feasible to apply Braille tags on every stocked product in a grocery store - the U. S. Council for Better Business Bureau observes that, ”for most grocery stores, putting all price labels in Braille could not be done without significant expense.” The Council for Better Business Bureau goes on to offer the following alternative for grocery shopping for the blind: ”A store employee could offer to assist customers who are blind or who have limited vision by describing the items and reading prices and labels unless an undue burden would result. When merchandise and price information are available on a display board at a deli, bakery, or other service counter, high-contrast signs or large print handouts are helpful for people with limited vision." However, asking for a store employee's assistance certainly robs a blind person of his/her independence; similarly, posting large-print or high-contrast signs is not really useful for completely blind individuals. Most of the practical suggestions provided by the National Federation of the Blind for grocery shopping invariably involve the assistance of a sighted guide, typically, a friend, neighbor or a grocery store clerk. Note that typical blind navigation aids, such as a cane or a guide dog, are of little use in a grocery-store environment, because the stores often change the locations of stocked items, and because these aids do not really help to distinguish between various grocery items. The blind person might not really have the luxury to browse products unassisted. Furthermore, his scenario inevitably hampers the independence of blind shoppers, requires them to plan their shopping trips around times that the store is likely to be more or less empty, and makes them more reluctant to purchase a large number of items for fear of overly bothering the store clerks.

Chapter 4

System analysis

4.1 Existing Systems

Trinetra: Assistive Technologies for the Blind. Patrick E. Lanigan, Aaron M. Paulos

Trinetra aims to develop cost-effective assistive technologies to provide blind people with a greater degree of independence in their daily activities. The original Trinetra prototype is a barcode-based solution comprising a combination of off-the-shelf components, such as an Internet and Bluetooth.

Shopping Assistant for the Visually Impaired. Andrew Ebaugh, Saurav Chatterjee

SAVi, a Shopping Assistant for the Visually Impaired, is a system designed to aid the blind or the sight-impaired shopper in identifying and selecting products off the shelf in a store. Utilizing Radio frequency Identification (RFID) tags and ubiquitous computing devices, SAVi looks to take advantage of the tags which may soon be universally affixed to products in grocery stores and supermarkets. A glove device with an integrated RFID scanner is worn by the user, and scans ID tags as products are handled. This information is transmitted to a hip-worn personal server, and audio feedback is provided to the user, communicating the name, brand, and price of the item. SAVi seeks to address an important accessibility issue with low-cost RF-technology and ubiquitous computing components.

Grocery Shopping Assistant for the Blind/Visually Impaired

The GroZi project is working to develop a portable handheld device that can ”see”, allowing the blind and visually impaired to navigate more efficiently within difficult environments as well as better locate objects and locations of interest. GroZi's is focused on the development of a navigational feedback device that combines a mobile visual object recognition system with haptic feedback. The GroZi system will allow a shopper to navigate the supermarket, and specific aisles, read aisle labels, scans the aisle for products on the shopping list and direct the shopper to acquire the product.

ShopTalk: Independent Blind Shopping Through Verbal Route Directions and Barcode Scans

ShopTalk is a proof-of-concept wearable system designed to assist visually impaired shoppers with finding shelved products in grocery stores. Using synthetic verbal route directions and descriptions of the store layout, ShopTalk leverages the everyday orientation and mobility skills of independent visually impaired travellers to direct them to aisles with target products. Inside aisles, an off-the-shelf barcode scanner is used in conjunction with a software data structure, called a barcode connectivity matrix, to locate target product on shelves. ShopTalk was successfully used to guide visually impaired shoppers to multiple products located in aisles on shelves. ShopTalk is a feasible system for guiding visually impaired shoppers who are skilled, independent travelers. Its design does not require any hardware instrumentation of the store and leads to low installation and maintenance costs.

4.2 Proposed System

It assumes that a standardized RFID product database, similar to the publicly available UPC database utilized by existing Point-Of-Sale technologies, has been transferred to the small computing device that is part of the entire device system. The shopper is fitted with the system, which consists of a glove, a small pocket size computing device and a headphone earpiece. This is provided by the supermarket. Upon arriving to a store that makes use of RFID tag technology, the shopper enables their glove. At the product aisles, RFID tags are affixed to the products of every section. These tags contain the information about the products available in that section of the supermarket and also the information about the products available in the neighboring aisle. This information helps the user to decide if he wants to continue and proceed within the same section or to move on to the next or previous section. Once the desired section is entered, a product is picked up and the palm of the glove is passed over its surface. This glove has an RFID reader embedded inside it. This reads the RFID tag and conveys this data to the pocket sized computing device. This device has within itself, a micro controller that interfaces with Bluetooth to transmit this data to a centralized server that is present in the supermarket. This processes the data and retrieves necessary information from the supermarket-database. This information is then sent wirelessly to the computing device that lies with the user. This makes use of a text to speech converter and emits an audio output. The earpiece commences an audio description of the product in the user's ear.

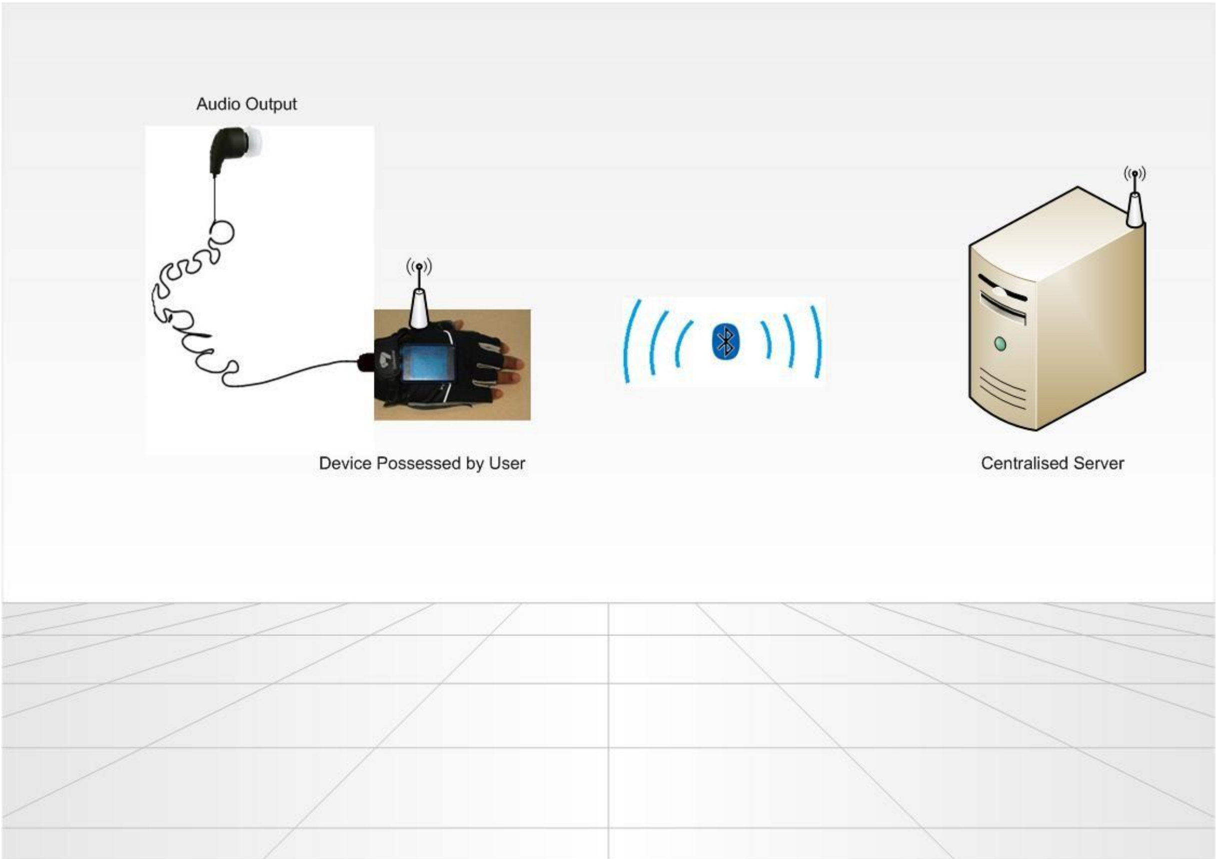

Figure 4.1: ProposedSystem

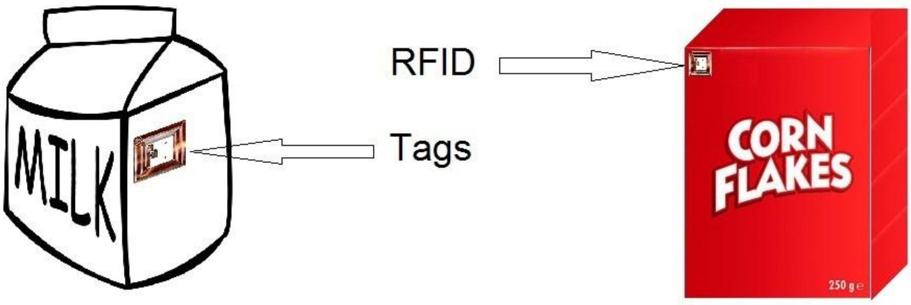

Figure 4.2: RFID Tags on Products

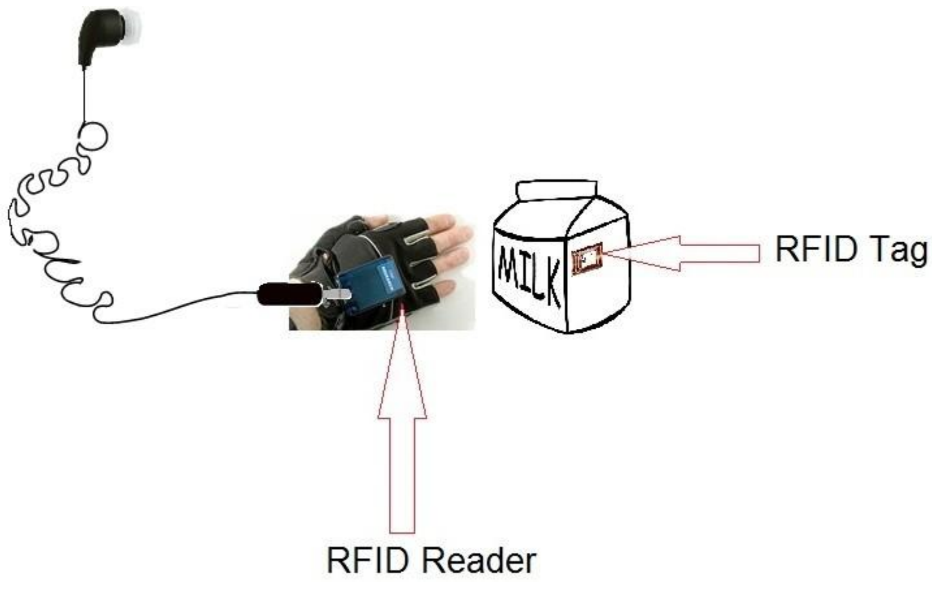

Figure 4.3: Proposed System

4.3 Feasibility Study Report

4.3.1 Operational

Since the system relies on the central server which has a large database storage capacity, it can accommodate the quintessential details about the individual sections/aisles inside the super- market and also about the products viz. brand name, product type, price, weight, date of expiry, etc. It does not involve much hardware installations. The device (reader microcontroller audio output assembly) has to be handed over to the user on arrival at the entrance gate by the same employee who hands over the shopping cart. ATmega128 makes the interfacing between RFID readers and the wireless server simple by means of Bluetooth connectivity. Bluetooth connectivity makes 2 way communications easier and faster since we are only targeting a limited radius, i.e. only the present supermarket floor. If more than one visually impaired user is present on the same floor, interference of transmitted data doesn't occur due to pre-defined authorization. Any updating required as per the stock details in the supermarket, can be easily done in the centralized server.

4.3.2 Technical

The microcontroller being employed can have customized functions by programming it in Embedded C. this makes it easy to make specific changes in its functions depending on the physical positioning of the sections in the supermarket. The interfacing between the physical hardware and the database can be easily done using VB. Bluetooth connectivity is programmable with visual basic too. Communication with the server becomes better with this environment. The database that is required holds with itself, the key details about the products. Majority of these details are in the text format. Therefore, MS Access is good option. If the supermarket wished to make its vicinity Wi-Fi enabled, the same type of database can be retained without any significant changes.

4.3.3 Economical

This system is financially feasible. Its development can be done at a price affordable by supermarkets who wish to make use of this technology. Since the device will be retained by the supermarket, and will only be provided to the user till he finishes with his shopping. Thus, a limited no. of devices can suffice the need. RFID tags are commonly available at Rs.40/-(approx.) per tag and readers cost about Rs 2000/-, which are reasonable prices considering the manual work and errors that get avoided. The prototype we have constructed involved an investment of approximately Rs. 7500. The split up is mentioned as follows:

Sr No	**Component**	**Cost (in Rs.)**
1	ATmega 128L Microcontroller	300
2	RFID Reader	300
3	RFID Tags	200(40x5)
4	Bluetooth Adaptor	3600
5	SPO 256A AL2 Speech Synthesiser	400
6	9V Battery	50(25x2)
7	Misc. (Wires, Ports, Connectors, PCBs, LEDs, Capacitors, Resistors, Crystal Oscillators)	1700
8	**Total**	**7500**

Table 4.1: Cost Split-up

4.4 Project Estimation

Software project estimation is a form of problem solving. Today, software is the most expensive element of virtually all computer based systems. For complex, custom systems, a large cost estimation error can make the difference between profit and loss. Cost overrun can be disastrous for the developer. Hence viable approaches to software project estimation are used.

4.4.1 Cost Estimation

LOC/Function Point based estimation using COCOMO model
FP based Estimation
FP-based estimation focuses on the information domain values such as inputs, outputs, inquiries, files and external interfaces for CLASS. For the purpose of this estimate, the complexity weighting factor is assumed to be average. The below mentioned table presents the result of this estimate:

Information Domain Value	Count	Weight	FP-Count
Number of Inputs	20	5	100
Number of Outputs	15	3	45
Number of Inquiries	12	4	48
Number of Files	18	10	180
Number of External Interfaces	10	5	50

Table 4.2: FP-Based Estimation Result Table

Count-Total = 423

The estimated FP is derived using the formula:
FP=COUNT-TOTAL*[0.65+0.01*?Fi]

Fi = 34
Complexity adjustment factor [0.65+0.01*34] =0.99 = 1
Finally the estimated of FP is derived:
FP=count-total*[0.65=0.01*?Fi]
FP=423*1
FP=423
Considering our average productivity is 141 FP/pm and labor rate is assumed to be INR 200 per month, the cost per FP is approximately INR 1.5, making the project cost INR 5000.

Factor	Value
Backup and recovery	4
Data communication	2
Distributed processing	0
Performance critical	4
Existing operating environment	3
On-line data entry	0
Input transactions over multiple screens	0
Master files update online	3
Information values complex	3
Code design for reuse	4
Conversion/installation in design	3
Multiple installations	3
Applications designed for change	5

Table 4.3: Weighting Factors Table

4.4.2 Effort Estimation

Effort estimation is required to find the number of people required to complete the project over the duration of the project. We are using an estimation model that uses empirically derived formulas to predict effort as function of LOC or FP i.e. the COCOMO model. We have used function points (FP) as a sizing option as a part of model hierarchy.

Consider the following software instruction:

$E= [LOC*B^0.333/P]^3 * (1/t^4)$

Where,

E = Effort in person – month or person – years t = Project duration in months or years
B = Special skills factor which increases slowly as the need grows. P = Productivity parameter.
t= 6 months change the values
LOC = 5200 lines of code.

P =12000
B = 0.16

Therefore by substituting above values we get : –
E = 3.8 persons/months = ~4 person/month
Thus, the estimated effort required for project name is 4 persons over a period of 3 months.

4.4.3 Time Estimation

Scheduling is an inexact process in that it tries to predict the future. While it is not possible to know with certainty how long a project will take, there are techniques that can increase your likelihood of being close. If you are close in your planning and estimating, you can manage the project to achieve the schedule by accelerating some efforts or modifying approaches to meet required deadlines.

One key ingredient in the scheduling process is experience in the project area; another is experience with scheduling in general. In every industry area there will be a body of knowledge that associates the accomplishment of known work efforts with time duration. In some industries, there are books recording industry standards for use by cost and schedule estimators. Interviewing those who have had experience with similar projects is the best way to determine how long things will really take.

When preparing a schedule estimate, consider that transition between ac- tivities often takes time. Organizations or resources outside your direct con- trol may not share your sense of schedule urgency, and their work may take longer to complete. Beware of all external dependency relationships. Uncer- tain resources of talent, equipment, or data will likely result in extending the project schedule.

Experience teaches that things usually take longer than we think they will, and that giving away schedule margin in the planning phase is a sure way to ensure a highly stressed project effort.

Chapter 5

Software Requirement Specification

Software Requirements Specification

WIRELESS SHOPPING ASSISTANT FOR THE VISUALLY IMPAIRED

Siddharth Gupta

Abhijeet Desai

Version: (1.0) Date: (20/04/2011)

1.Introduction

1.1 Purpose

Currently, blind shoppers require assistance of some form or another in order to successfully buy the products they need and return them to their home. Solutions range from small Braille tags applied to products they regularly shop for, to being led around by a shopping assistant or store manager. Any of these methods require special arrangements to be made in advance and reinforce a feeling of dependence when conducting what is really a basic necessity for living. Even after they have selected the products they want to purchase, individuals encounter further problems.

A Wireless Shopping Assistant for the Visually Impaired is a system designed to aid the blind or the sight-impaired shopper in identifying and selecting products of the shelf in a store. It is designed to seek to aid the blind or the sight impaired shopper in independently identifying and selecting products off the store shelf without the need of human assistance. It has been build up on the fact that although the sight impaired may lack full use of their visual senses, they still retain their functional tactile and auditory perceptions as their strengths.

1.2 Scope

The project is designed to aid the blind or the sight impaired shopper in independently identifying and selecting products off the store shelf without the need of human assistance. The project is developed in the hopes of empowering visually impaired individuals to shop at their own convenience. The proposed project is connected to single centralized server so any updating or modification needs to be done only on the server side and not on single devices.

2. Specific Requirements

2.1 Functional requirements

Functional requirements capture the intended behavior of the system. This behavior may be expressed as services, tasks or functions the system is required to perform. In this project, our primary requirement is to provide electronic assistance to the user. It can be enlisted as follows:

Req 1: An automated GUI: To provide a developer-friendly platform to make changes and update data when necessary, but at the same time, work as a standalone system that doesn't require human intervention otherwise.

Req 2: Faster execution speed: Providing faster execution capability to the software.

Req 3: User Throughput: Enabling more instructions to be carried out in lesser time.

Req 4: Help and technical support: Providing help to the user whenever required.

2.2 Non-Functional requirements

Non-functional requirements impose constraints on the design or implementation (such as performance requirements, quality standards or design constraints). Users have implicit expectations about how well the software- hardware assembly will work. These characteristics include how easy the product is to use, how quickly it executes, how reliable it is, and how well it behaves when unexpected conditions arise.

The proposed system takes advantage of the ATmega128L architecture interfaced with an RFID Reader, which reads an RFID Tag. Via Bluetooth, it sends the Tag ID to a centralized server. Here the data retrieval occurs and hence the desired details are transmitted back to the device. The microcontroller then sends this data to the speech synthesizer which converts this data into an audio signal that gets played for the user.

Since the system is server-centralized, it might fail if the server goes down, in which case the clients must either wait for the server to recover or have a standby back up server.

2.3 Minimum Hardware/Software Requirements:

1. Hardware Requirements:

The back-end runs on a computer (server) that has a minimum of the following hardware requirements :

- Processor 1.5 GHz
- 20MB hard disk space
- 256MB RAM

Bluetooth connectivity/ USB console for Bluetooth Dongle.

2. Software Requirements

Suitable for use on an internal network/PAN.

- OS: Windows XP or above
- GUI: MS Visual Studio
- Database: MS Access

Chapter 6

Hardware Details

6.1 ATMega 128L Microcontroller

6.1.1 Features

- Includes Powerful Atmel ATMega128 Microcontroller with 128kb Internal Flash Program Memory
- Operating Speed at 16MHz with up to 16 MIPS throughput
- In-Circuit Programming via ET-AVR ISP
- A massive 48 I/O points with easy to connect standard IDCC Connectors
- 2 RS232 Connections with MAX232
- LCD Connector with Contrast Adjustment
- 8 Channel 10-bit A/D Convertor
- Two 16-bit Timers with Two 8-bit Timers
- 4kbyte EEPROM
- Power LED
- Reset Button
- Ideal as an Interchangeable Controller for Real-Time System.
- Reset Button
- Ideal as an Interchangeable Controller for Real-Time System.

6.1.2 Overview of ATmega128L

The ATmega128 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega128 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The result- ing architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

Figure 6.1: ATmega 128L Microcontroller

6.1.3 Architecture

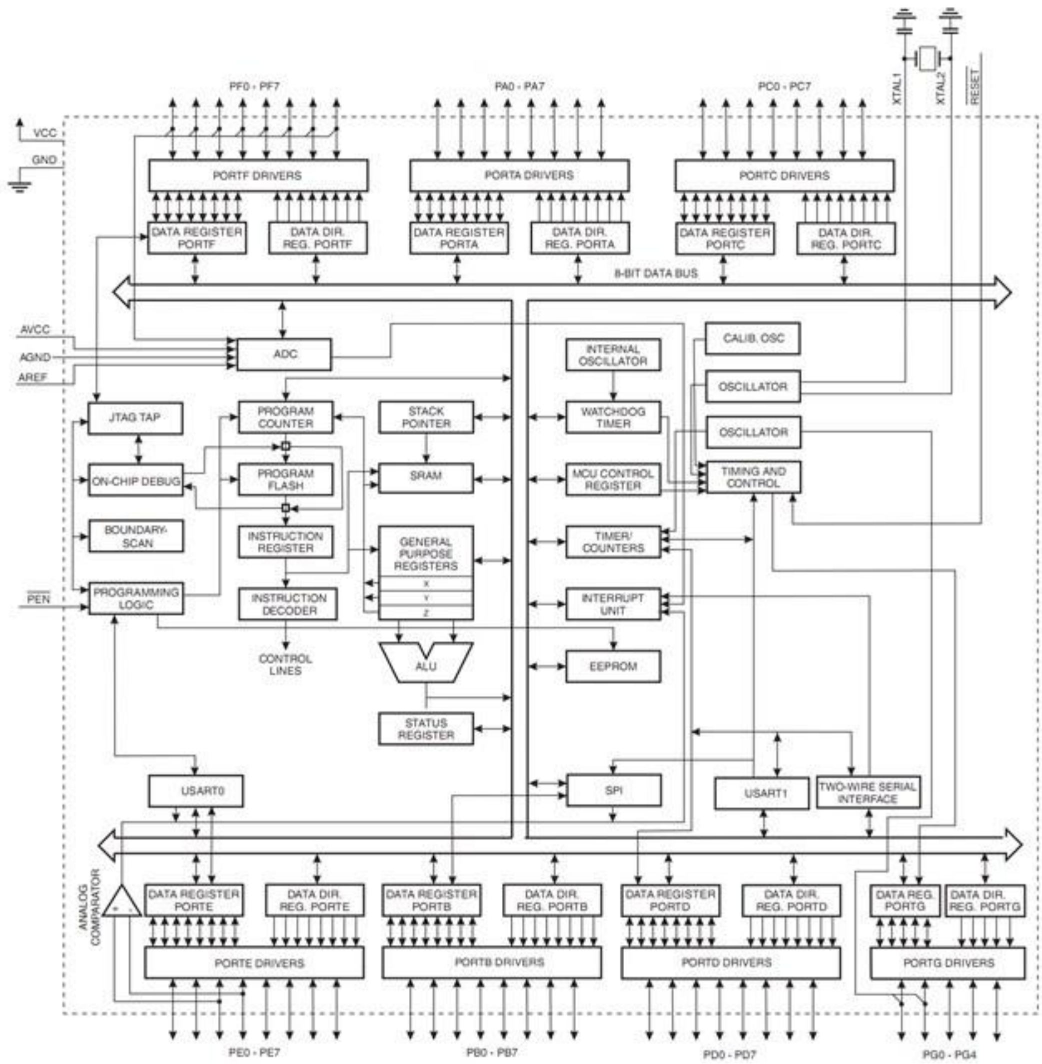

Figure 6.2: Architecture of ATmega 128L

6.2 Bluetooth Adaptor

Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each) in the range 2402-2480 MHz. This range is in the globally unlicensed Industrial, Scientific and Medical (ISM) 2.4 GHz short-range radio frequency band.

Figure 6.3: Bluetooth Adaptor

6.3 RFID Technology

Radio-frequency identification (RFID) is the use of an object (typically referred to as an RFID tag) applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader.

6.3.1 RFID Reader

An RFID reader is a device that is used to interrogate an RFID tag. The reader has an antenna that emits radio waves; the tag responds by sending back its data.
A number of factors can affect the distance at which a tag can be read (the read range). The frequency used for identification, the antenna gain, the orientation and polarization of the reader antenna and the transponder antenna, as well as the placement of the tag on the object to be identified will all have an impact on the RFID system's read range.

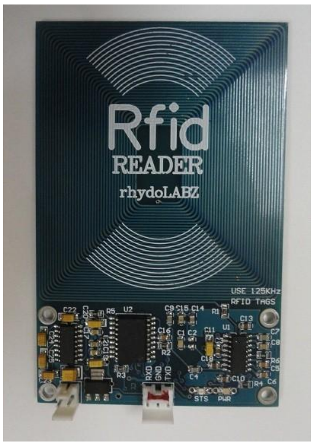

Figure 6.4: RFID Reader

6.3.2 RFID Tags

An RFID tag is an active tag when it is equipped with a battery that can be used as a partial or complete source of power for the tag's circuitry and antenna. Some active tags contain replaceable batteries for years of use; others are sealed units.

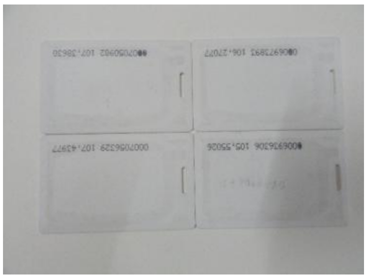

Figure 6.5: RFID Tags

6.4 SPO256A AL2 (Speech Processor)

The SPO256 (Speech Processor) is a single Chip N-Channel MOS LSI device that is able, using its stored Program, to synthesize speech or complex sounds. The achievable output is equivalent to a flat frequency response ranging from 0 to 5 kHz, a dynamic range of 42dB, and a signal to noise ratio of approximately 35dB.

Figure 6.6: SPO256A AL2 Speech Processor.

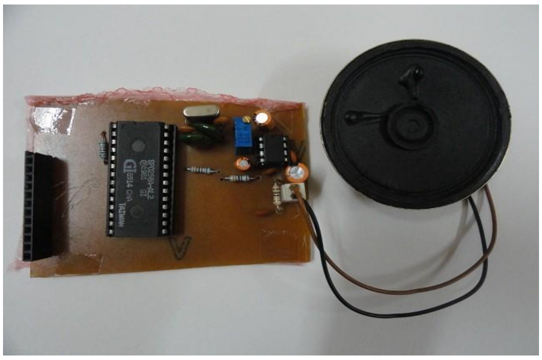

Figure 6.7: Audio Output Assembly.

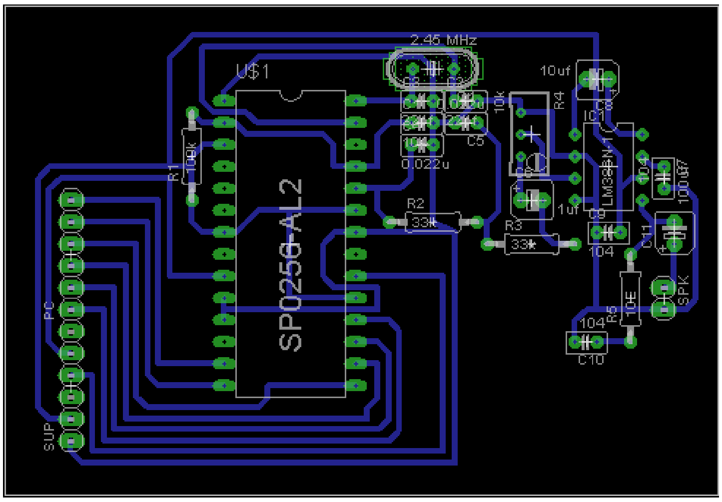

Figure 6.8: SP0256A Circuit Board.

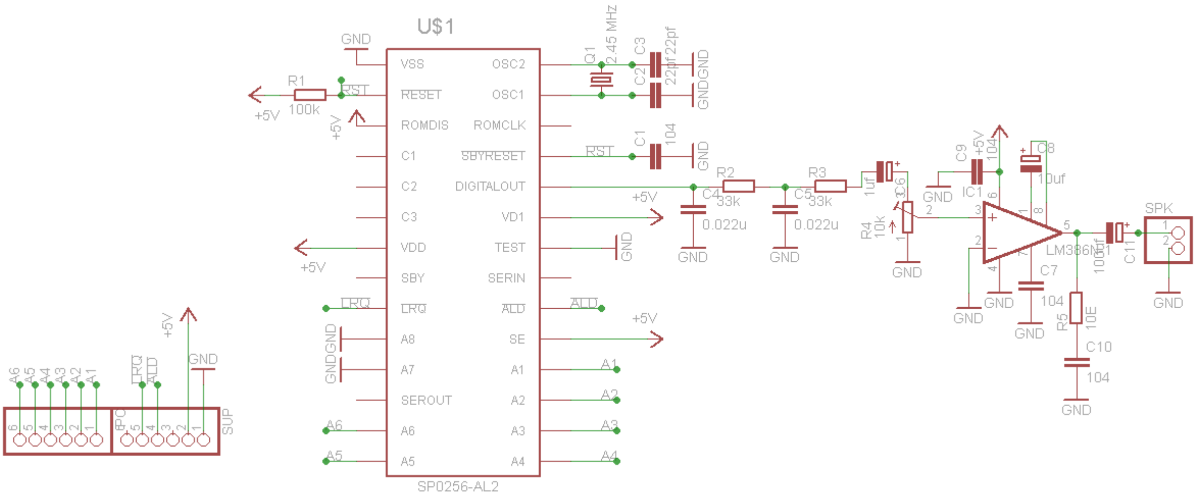

Figure 6.9: SP0256A Circuit Diagram.

6.5 Miscellaneous Hardware

Figure 6.10: Printed Circuit Board.

Figure 6.11: 9V Battery.

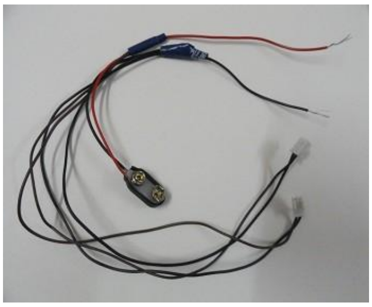

Figure 6.12: Connectors.

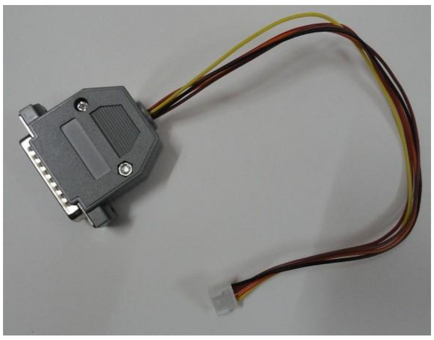

Figure 6.13: Parallel Port Connector (for Flash Programming).

6.6 Complete Circuit Assembly

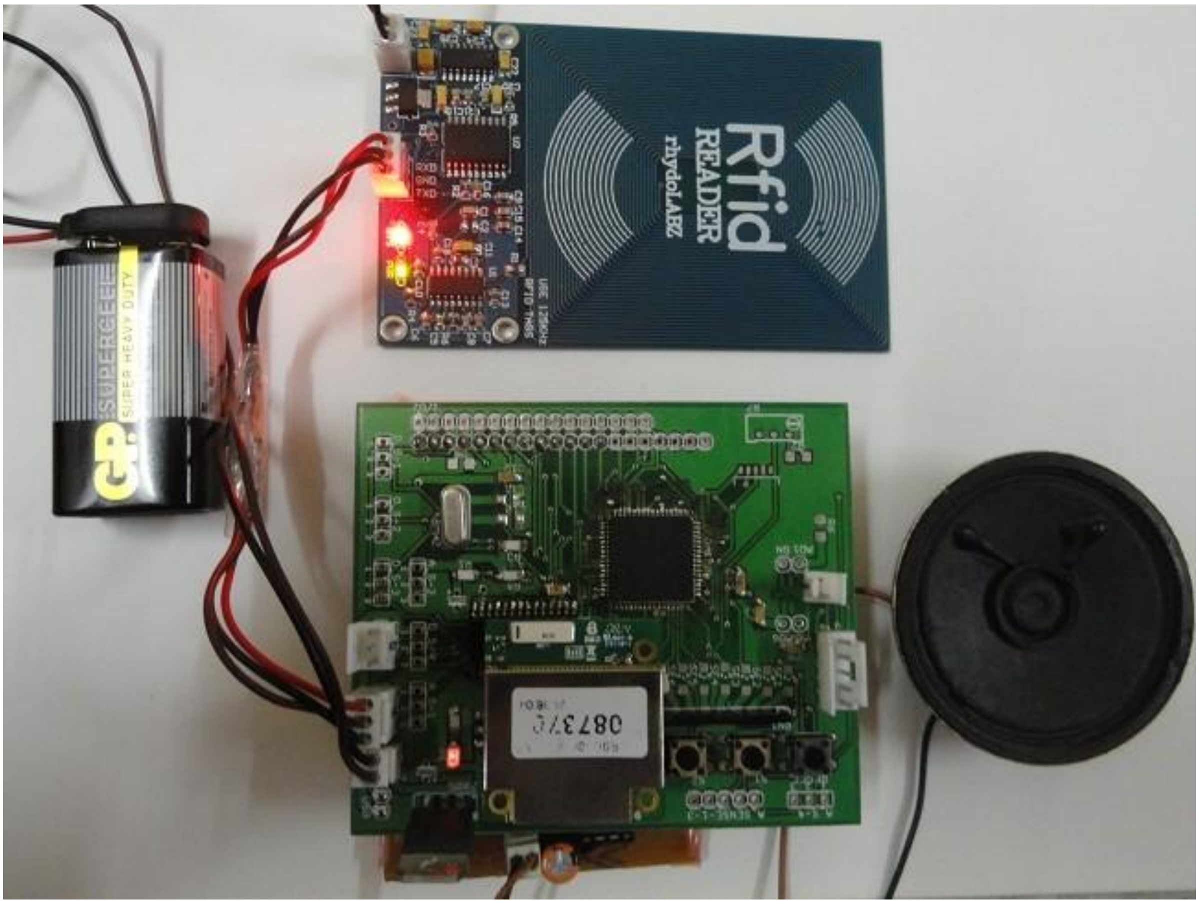

Figure 6.14: Complete Circuit Assembly.

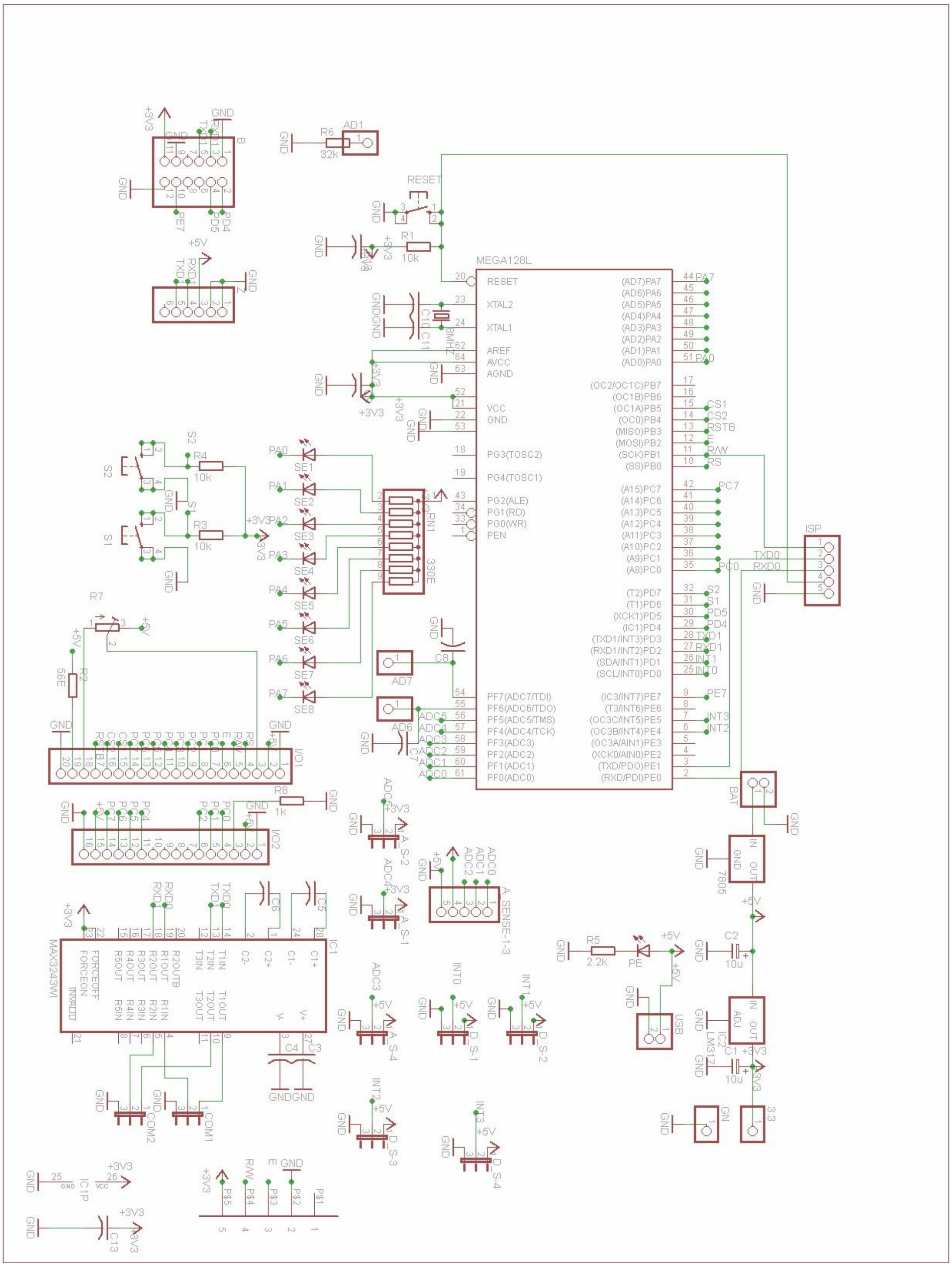

Figure 6.15: Complete Circuit Diagram

Chapter 7

System Design

7.1 Preliminary System Design

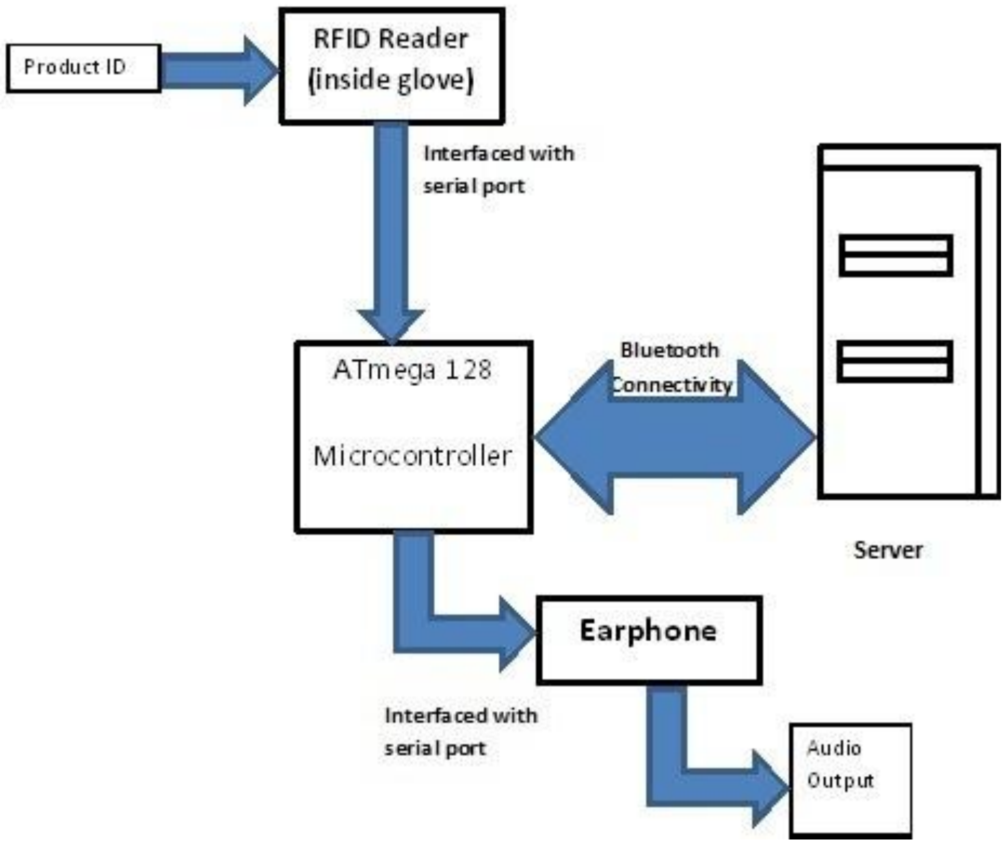

Figure 7.1: Block Diagram.

7.2 System Modelling

UML Diagrams

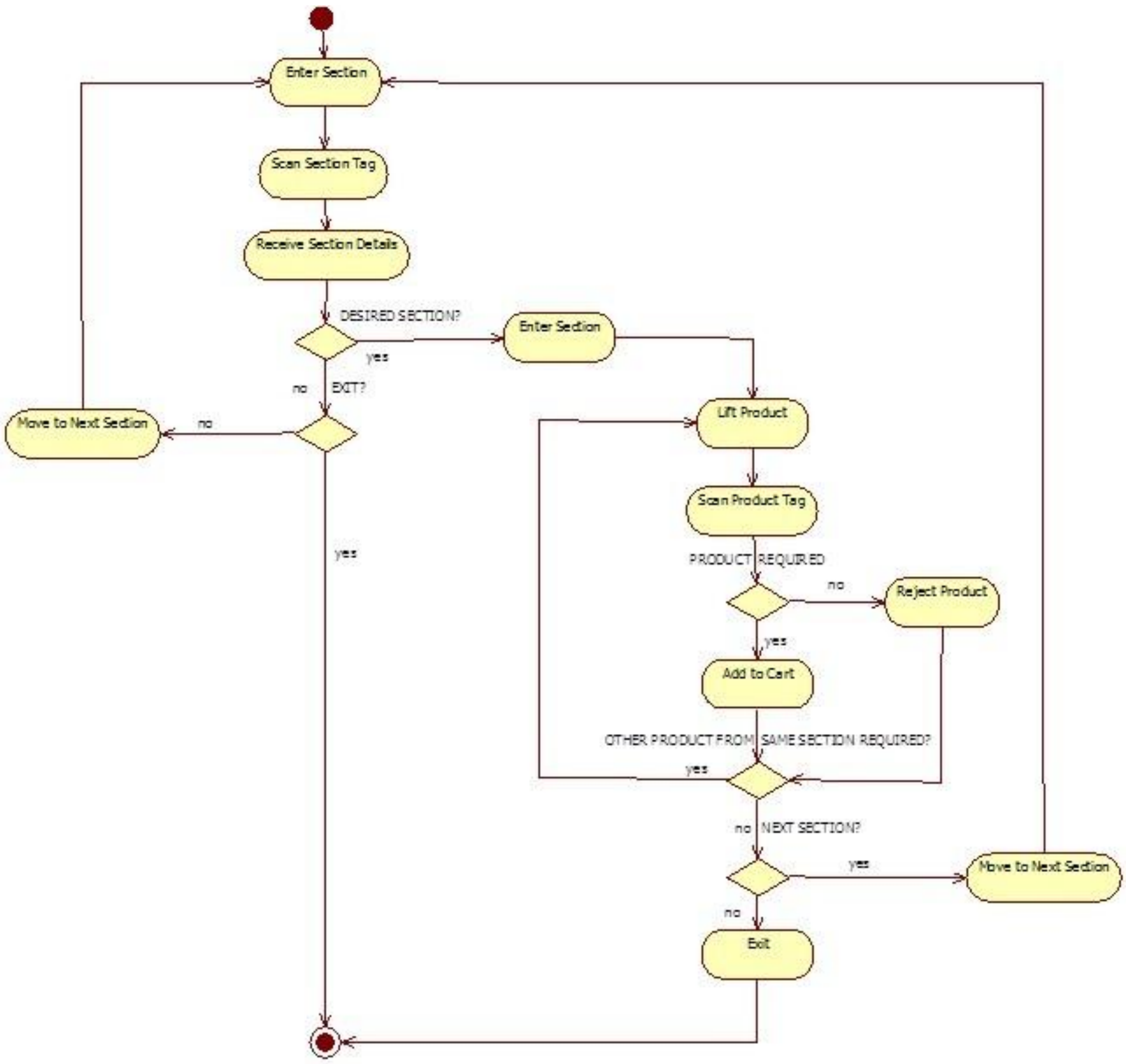

Figure 7.2: Activity Diagram.

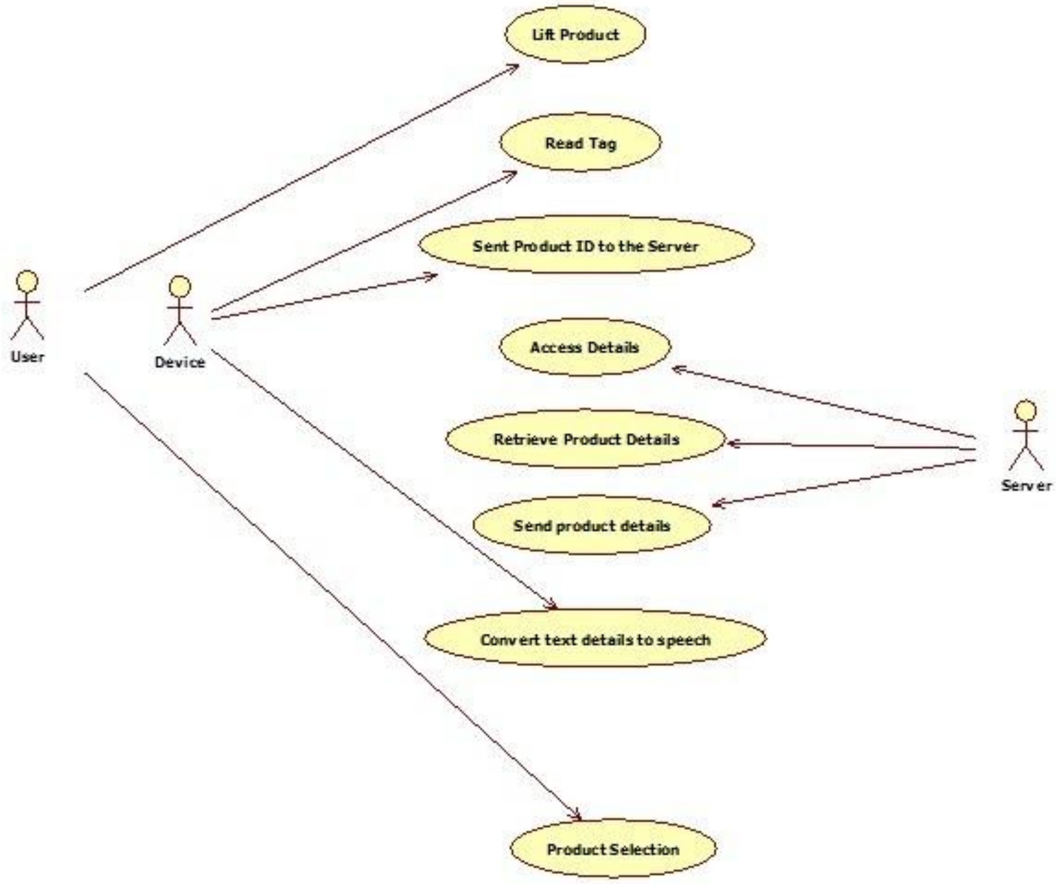

Figure 7.3: Use Case Diagram.

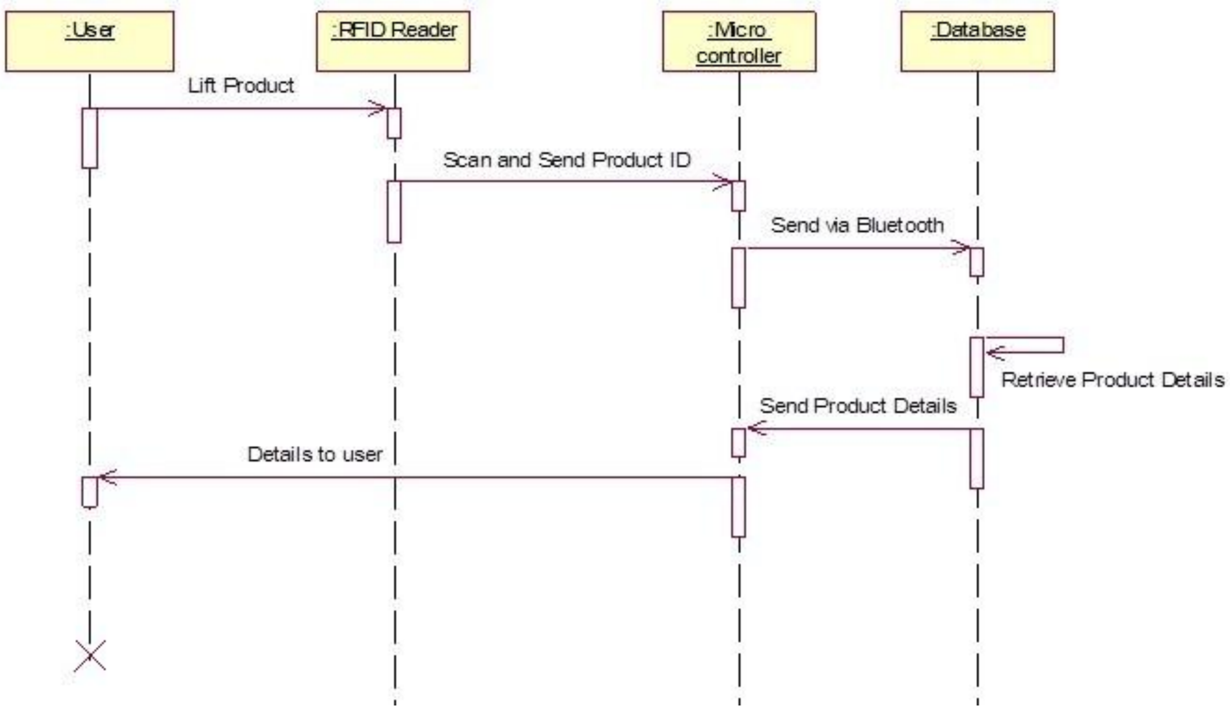

Figure 7.4: Sequence Diagram.

7.3 Dataflow Diagrams

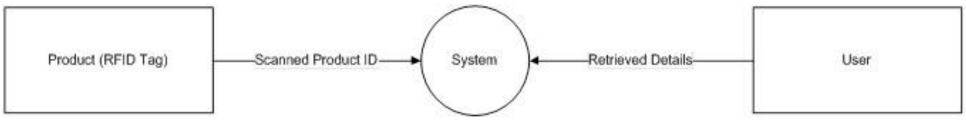

Figure 7.5: Level 0

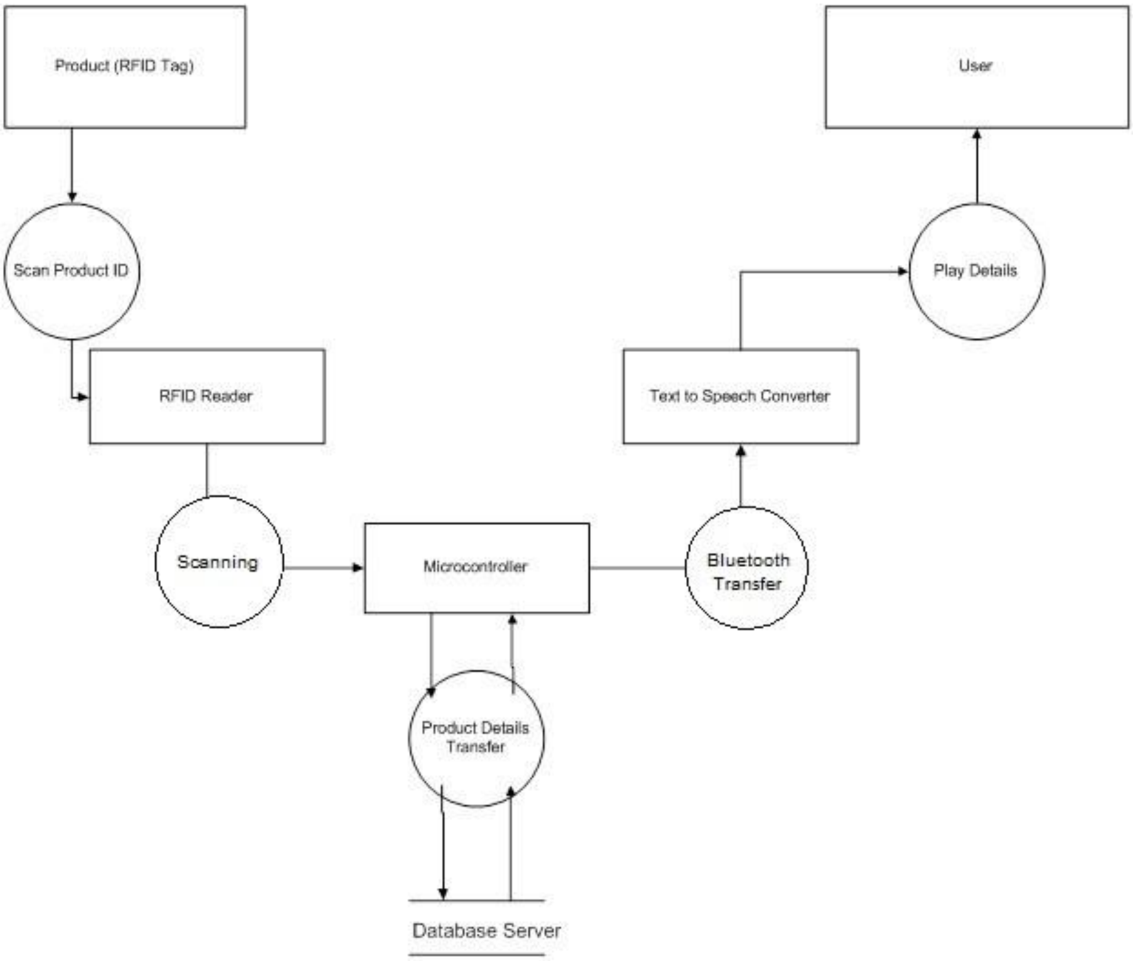

Figure 7.6: Level 1

Chapter 8

Implementation

We have designed a graphical user interface in visual basic as the back end. This interface establishes a connection with the database. This is the same database that holds all the records of products already available in the supermarket and also those that are continuously being added or subtracted from the existing stock. This user interface does not require any human intervention for its functional operation. It has only been made to address the problems or connection scenarios that may arise in case of errors like multiple data anomalies or redundancy.

Following are some of the screenshots while in operation:

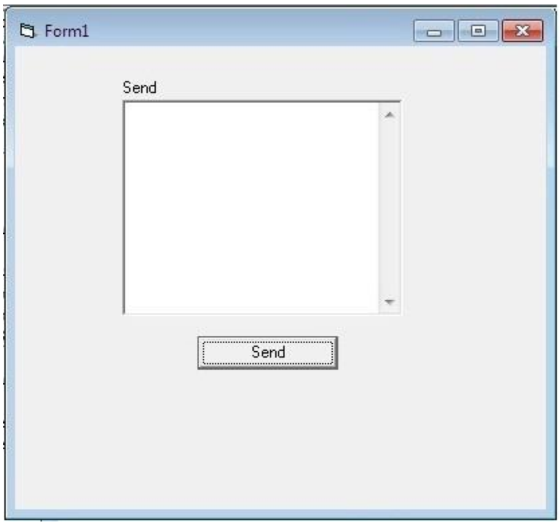

Figure 8.1: Form to display details on the Server side.

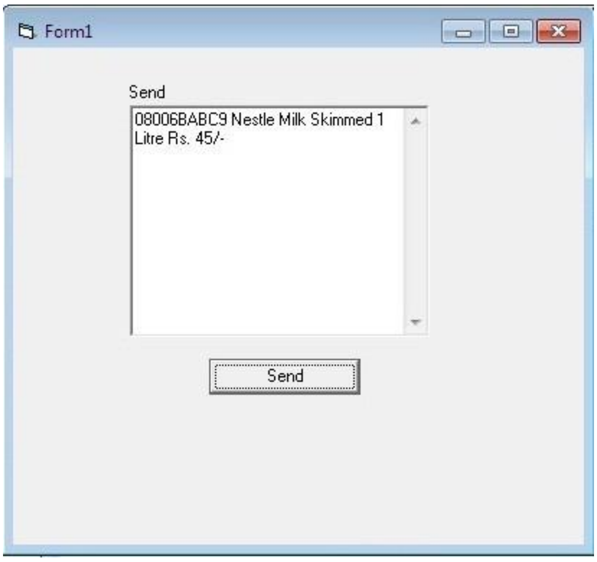

Figure 8.2: Details of Products Being Sent to the Device

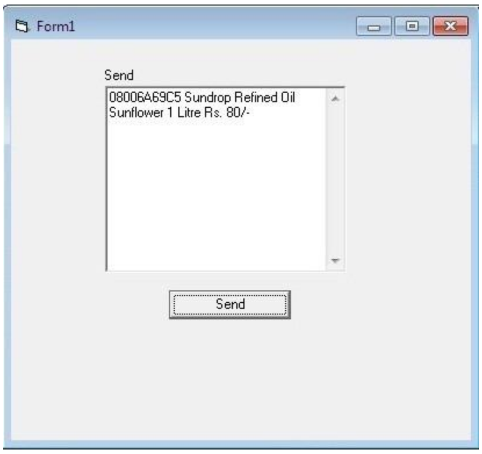

Figure 8.3: Details of Products Being Sent to the Device

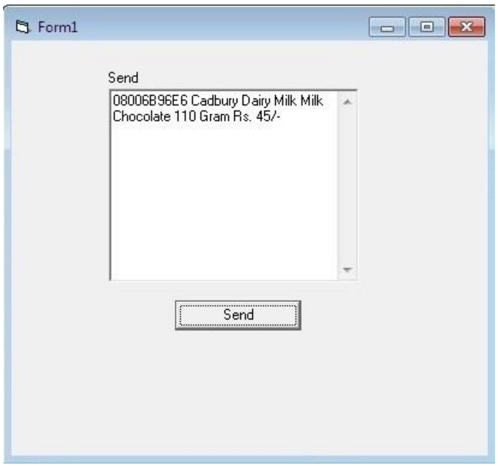

Figure 8.4: Details of Products Being Sent to the Device

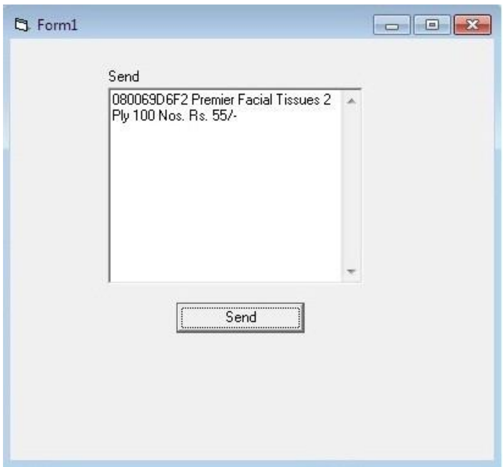

Figure 8.5: Details of Products Being Sent to the Device

Chapter 9

Testing

Testing is the process of executing the program with the intent of finding errors. The system has been tested according to the following test mechanisms:

- Unit Testing.
- Integration Testing.
- System Testing.
- Validation Testing.

9.1 System Testing

System testing is the testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. System testing falls within the scope of Black box testing, and as such, should require no knowledge of the inner design of code or logic. Alpha testing and Beta testing are sub categories of System testing. As a rule, System testing takes, as its input, all of the 'integrated' software components that have successfully passed integration testing and also the software system itself integrated with any applicable hardware system(s).

The test plan outlines the entire testing process and includes the individual test cases. To develop solid test plans, one must systematically explore the program to ensure coverage is thorough, but not unnecessarily repetitive. A formal test plan establishes testing process that does not depend upon accidental, random testing. Testing, like development, can easily become a task that perpetuates itself.

9.2 Unit Testing

In computer programming a unit test is a procedure used to validate that a particular module of source code is working properly. The procedure is to write test cases for all functions and methods so that whenever a change causes a regression, it can be quickly identified and fixed. Ideally, each test case is separate from the others; constructs such as mock objects can assist in separating unit test. This type of testing is mostly done by the developers and not by end-users.

9.3 Integration testing

Integration testing is a phase of software testing in which individual software modules are combined and tested as a group. It follows unit testing and precedes system testing. Integration testing takes as its input module that have been checked out by unit testing, groups them in larger aggregates, applies tests define in an integration test plan to those aggregate, and delivers as its output the integrated system ready for system testing. The purpose of Integration testing is to verify functional, performance and reliability requirements placed on major design items. These 'design items', i.e. assemblages (or groups of units), are exercised through their interfaces using Black box testing, success and error cases being simulated via appropriate parameters and data inputs. The overall idea is 'building block' approach, in which verified assemblages are added to a verified base which is then used to support the integration testing of further assemblages. The different types of Integration testing are Big Bang, Top Down, Bottom Up and Back Bone.

9.4 Regression Testing

Regression testing is any type of software testing which seeks to uncover regression bugs. Regression bugs occur whenever software functionality that previously worked as desired stops working or no longer works in the same way that was previously planned. Typically regression bugs occur as an unintended consequence of program changes. Sometimes it occurs because a fix gets lost through poor revision control practices (or simple human error in revision control), but just as often a fix for a problem will be ”fragile” - if some other change is made to the program, the fix no longer works.

9.5 White Box Testing

White box testing, clear box testing, glass box testing or structural testing is used in computer programming, software engineering and software testing to check that outputs of a program, given certain inputs, conform to the structural specification of the program. The term white box indicates that testing is done with knowledge of the code used to execute certain functionality. For this reason, a programmer is usually required to perform white box tests. A complementary technique, black box testing, performs testing based on previously understood requirements, without knowledge of how the code executes.

9.6 Black Box Testing

Black box testing, concrete box or functional testing is used in computer programming, software engineering and software testing to check that outputs of a program, given certain inputs, conform to the functional specification of the program. The term black box indicates that the internal implementation of the program being executed is not examined by the tester. For this reason, black box testing is not carried out by the programmer. In most real-world engineering firms, one group does design work while a separate group does testing.

Test Cases of GUI Module:-

Test Case Id: 01

Test Objective: *To test the GUI of the system*

Item No	Test Condition	Operator Action	Input Specification	Output Specification	Pass/Fail
1	Successful reception of RFID Tag	RFID reader reads the RFID Tag.	RFID Tag	Retrieves data of respective RFID Tag	Pass
2	Successful reception of data.	Retrieves data from database of respective RFID Tag.	None.	Display product details of respective RFID Tag and send microprocessor.	Pass

Table 9.1: Test Cases of GUI Module

Chapter 10

Installation Maintenance

10.1 Installation

The prototype we have designed is a standalone device that would be powered by a battery supply, and shall remain independent of any further manual programming or updations on the device-side. The installation process is simple and fast.

It involves the following steps:

1. Connect a 9V battery to the power terminals of the device. This activates the microcontroller, Bluetooth adaptor and RFID reader.

2. Run the VB application in Visual Basic version 6.0 or above.
3. Link it to pre-existing database of all the enlisted products.
4. Scan and connect the device to the database server via Bluetooth pairing. The pairing passcode of the device is 1234. This authorises the device to communicate with the server without interference and repeated permission grants.
5. After step 4, verify that the COM Port that connects the device is the same as mentioned in the VB application. If not, reconfigure it with the new value of the COM Port.
6. A red LED blinking on the RFID Reader indicates that the device is unable to draw the desired power from the power source.
7. Once steps 1-7 are successfully carried out, the device is ready for use.

10.2 Maintenance

- We are making use of RFID Tags for the simple reason that they can be used and reused repeatedly. As and when a new product has stocked up in the supermarket, a tag must be affixed to it and an update should be made in the database with the new Tag ID associated with the product.
- This is the database that holds all the records and is linked directly to the inventory.
- A regular maintenance of this database ensures smooth and uninterrupted working of the entire system.

Chapter 11

Conclusion

Assistive technologies have been given a considerable degree of importance since the past decade. With the advent of newer, faster and accurate microprocessors and microcontroller, development in this field got an urge to a completely new level. Enabling the disabled was a chief motto of this revolution. If an individual lacks a sensory perception, then he/she can still compensate for this with an intelligent use of his/her other sensory perceptions. For many years, the blind have been reading brail using their tactile sense. They are able to locate an object on the basis of the sound it emits. Assistive technologies help to make this process easy and less effort demanding.

Our project was a step towards developing a module applying the same technology. This Wireless Shopping Assistant for the Visually Impaired will surely make a shopping experience for the user an easier process.

Chapter 12

Future Scope

The future seems pretty bright for the prototype that we have tried to implement. We have constructed a very basic device. But as far as up gradations and modifications are concerned, it wouldn't be wrong if one says that they are limitless. As of now, we are using a single, centralized server for ease of maintenance. But, using a flash memory device, integrated with the device will allow it to hold the entire database of products. Since all these devices would have Bluetooth connectivity, the database updating can be done by establishing a synchronization connection.

Also extra features may be added to it, for example, to 'speak' the time as and when needed. If a device is made user-specific, the same controller can be used to develop a 'Favorites List' by drawing inferences from the history of the user's choice of products. Using sectional tags, this concept can be used to direct the user to the necessary section.

RFID technology being reliable and robust, can be applied is several real world scenarios to assist the visually impaired. Using the same device, and programming the controller in a different way, it can be used to help them in making public transport usage simpler for them. Railway stations and bus stops can have hi range RFID Tags located at regular intervals that would emit the information like which platform the user is currently on, which way to move, in case he wishes to go on another platform, or the name of bus stops and which all buses halt there, etc. possibilities are endless. We just need to explore the depths of these simple assistive technologies.

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