# LIBRARY BOOK-SHELF MANAGEMENT SYSTEM USING RFID

Project Report submitted in partial fulfilment of the Requirement for the degree of

Bachelor of Technology

In

**Electronics and Communication Engineering**

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# CERTIFICATE

This is to certify that project report entitled "**LIBRARY BOOK-SHELF MANAGEMENT SYSTEM USING RFID**", submitted by Anurag Bhadauria (061028), Sudeep Sanan (061130) and Appoorv Narula (061153) in partial fulfillment for the award of degree of Bachelor of Technology in Electronics and Communication Engineering to Jaypee University of Information Technology, Waknaghat, Solan has been carried out under my supervision.

Date: 18/5/2010

**Mr. Jitender Mohan**
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Certified that this work has not been submitted partially or fully to any other University or Institute for the award of this or any other degree or diploma.

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# ABSTRACT

**Radio Frequency Identification (RFID)** is the latest technology that is being adopted to track and trace materials, including books. RFID based Library Management System has been implemented in most of the reputed libraries across the globe. RFID interfaced library management system, along with smart card issued to the users are being implemented to automate the library functions and make the inventory management process efficient and effective. The system improves the tracking of books and documents so that the books can be more quickly located, the document workflow more easily tracked and transaction records are seamlessly captured.

However the most common problem that arises is that the book in spite of being there in the library is not available in its proper shelf due to either wrong shelving or being hidden in shelves by students during exam time. Searching & even placing such book back in its original shelf requires a lot of time and physical labour.

We thought of implementing a novel technique to the whole concept of library management that would automate & simplify the process of searching for such misplaced books in book shelves.

As a result, we have developed a hand-held Scanner that would scan the book shelves not only to find any misplaced books but will also indicate their correct shelf number.

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# Chapter 1

# INTRODUCTION

RFID is a technology that is sparking interest in the library community because of its applications that promise to increase efficiency, productivity and enhance user satisfaction. Globally emerging knowledge-based societies of the twenty first century will need information to sustain their growth and prosperity. With intellectual capital as investments, knowledge and information have become wealth generators. In this scenario, who can deny the importance of libraries, which are repositories of reference resources?

A library stacked with books and other information dissemination processes, has a physical presence. A library is an institution of knowledge acquisition and learning; it provides invaluable service to its members, patrons and to a wider local community.

Current library management systems use barcode technology and security strips. Using barcodes, a library management system can keep records of lending, borrowing and shelving status of items such as books, audio or video tapes, CDs, DVDs, etc. Security strips on library items tag their movements. But barcodes and security strips (electronic article surveillance or EAS) have their limitations. They are slow to read and are prone to sabotaging by thieves. All these lead to irreparable loss to a library and its valuable inventory stock. This is where RFID technology can come to the aid of library managers and users.

Many libraries are switching over to RFID applications, for example, the Vatican Library. With its priceless, ancient collections of 2 million books and manuscripts, the Vatican Library is now using RFID to track, manage and secure its assets. The main problem these ancient libraries face are thefts, non-returns and mis-filed items. It is expected that by adopting an RFID solution the Vatican Library will be able to control misuse of its library and at the same time provide its users the best possible facilities and access to rare manuscripts.

RFID technology is not just there to tags books and other library assets; it will provide a comprehensive route for enhancing all library services and upgrade operations for everyone concerned with the library.

## 1.1 PROBLEM DEFINITION

During a day, library managers have to supervise many activities within their libraries. These activities have to be performed smoothly and simultaneously for the benefit of all persons concerned.

Some of the important functions in a library are:

- Check-in/check-out of items.
- Shelve items.
- Prevent thefts.
- Check inventory

If each of these functions is done by conventional methods, they will take time and lead to inefficiencies and unsatisfactory services to the library patrons.
Let us see how check-out of items is done with barcodes and EAS.

**Scan Patron Card ⇨ Receive Materials ⇨ Locate/Scan Barcode ⇨ Deactivate Security ⇨ Return Materials ⇨ Date Due Receipt**

It is a six step process. This is tedious and slow. If by using RFID technology this process is made for time-efficient, then it could be recommended.
As far as shelving is concerned, in a conventional library, it is done manually. In most busy libraries, many books, DVDs, audio cassettes and videos must be shelved every day. This is a time consuming task. Misplacement of items, mis-shelving of books, is quite common. Not only this, repetitive re-shelving task can be health risk to library staff. If automated, all these problems can be avoided.

Our project thus works towards automating the shelving process & it will ensure that there is:

- Quick availability of items for convenience of members.
- Quick and correct shelving of items.
- Easier & Better Shelf Management.
- Quick Inventory Check

RFID tags contain a memory chip and RF antenna that can send and receive several bits of data. Such RFID tags are known as smart labels or digital identification tags. These tags provide benefits of electronic article surveillance (EAS) as well as barcodes.

## 1.2 PROPOSED SOLUTION

For a library, smart labels have several added advantages over EAS and barcodes.
In a library, an RFID system consists of:

- A Smart label
- A Reader or hardware for interrogating the smart label.
- A Software for controlling the hardware and decoding the responses from smart labels

Since RFID tags do not have line of sight requirements:

- Many Items can be read simultaneously even whilst stacked.
- Items do not have to be opened and scanned one at a time.
- Items in multiple formats like books, CDs, etc. can be read at the same time

Sorting and shelving becomes quick, easy and accurate with RFID technology.
Once items are returned, a digital sort conveyor belt can place them in appropriate bins from where staff can place them in their correct shelves. With hand held mobile digital library assistant and inventory wand, the library staff can obtain data about shelving the item and other information immediately (catalogue number, shelf number, etc.).

Many libraries have found that with RFID technology inventory and scanning of items:

- Take only 10% or less time as compared to conventional systems.
- Misplaced books and other materials can be found easily – the reader can hone in on misplaced or wrongly shelved items quickly.
- Find cataloguing errors and replace incorrect spine labels

Besides these incredible technological advantages, an RFID system in a library can offer the following as well:

- RFID tags are safe for magnetic media such as CDs, DVDs, etc.
- Some RFID tags are rewritable. If, for example, a cataloguing error occurs, it can be rectified quickly.
- Less Manual handling of items hence better preservation.
- RFID 'smart' membership cards can give members: access control in certain areas, make payment (fines or fees) easy, lets them use fee-based library facilities such as the photocopier, internet, etc.
- Staff has more time from routine chores and can therefore provide better service to patrons.
- Staff schedules can be made flexible.
- Tags last longer than barcodes as reading is contact-less

Thus we build upon a hand held scanner to help in the library book shelf inventory & management system.

# Chapter 2

# RADIO FREQUENCY IDENTIFICATION (RFID)

## 2.1 What is RFID?

As the name RF implies it is a kind of identification system which uses radio frequency. RFID uses wireless technology operating with 50 KHz to 2.5GHz frequency range. It does not require any physical connection for identification between the unit to be identified and the identifier unit, which in this case is the reader. For automatic identification purposes, each piece of equipment (which is to be identified) shall be fitted with a small electronic device (called tag) containing unique identification code.

The tag in the presence of the sensing equipment (reader) operating on the ultra high frequency (UHF) radio waves reflects altered radio waves (modulated) to determine the identification of the equipment.

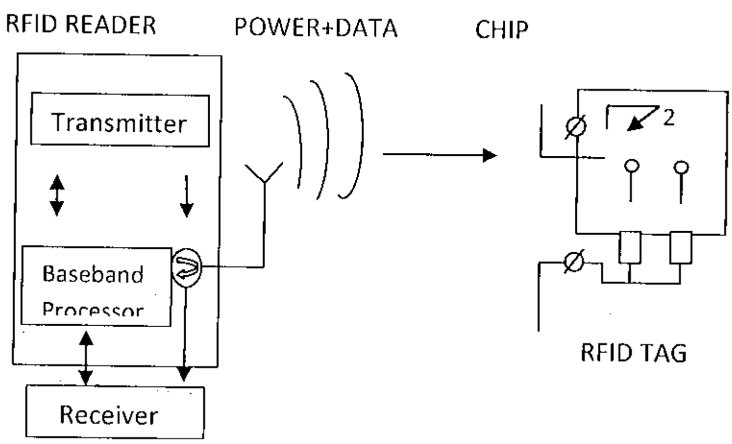



**Fig 2.1 RFID System Block Diagram**

## 2.2 LITERATURE SURVEY & HISTORY

This section is intended to give a background to the work performed in the thesis.

In 1946 Leon Theremin invented an espionage tool for Soviet Union which retransmitted incident radio waves with audio information. Sound waves vibrated a diagraph which slightly altered the shape of the resonator, which modulated the reflected radio frequency. Even though this device was a passive covert listening device, not an identification tag, it is considered to be a predecessor of RFID technology. The technology used in RFID has been around since the early 1920s according to the source (although the same source states that RFID system have been around just since the late 1960`s.)

Similar technology, such as the IFF transponder invented I the United Kingdom in 1939 was routinely used by the allies in the World War II to identify aircraft as friend or foe. Transponders are still used by most powered aircraft to this day.

Another early work exploring RFID is the landmark 1948 paper by Harry Stockman, titled "Communication by Means of Reflected Power". Stockman predicted that "Considerable research and development work has to be done before the remaining basic problems in the reflected power communication are solved, and before the field of useful applications is explored".

Mario Cardullo`s U.S patent 3,713,148 in 1973 was first true ancestor of modern RFID; a passive radio transponder with memory. The initial device was passive powered by the interrogating signal, and was demonstrated in 1971 to the New York Port Authority and other potential users and considered of a transponder with 16 bit memory for use as a toll device. The basic Cardullo's patent covers the use of RF, sound and light as transmission media. The original business plan presented to investors in 1969 showed uses in transportation (automotive vehicle identification, automotive toll system, electronic license plate, electronic manifest, vehicle routing, vehicle performance monitoring), banking (electronic check book, electronics credit card), security (personnel identification automatic gates, surveillance) and medical (identification, patient history).

A very early demonstration of the reflected power(modulated backscatter) RFID tags both passive and semi passive was performed by Steven Depp, Alfred Koelle, and Robert Freyman at the Los Almos National Laboratory in 1973. The portable system operated at the 915 MHz and used 12 bit tags. This technique is used by majority of today`s UHF-RFID and Microwave RFID tags.

## 2.3 TAG

RFID tag is a microchip combined with an antenna in a compact package; the packaging is structured to allow the RFID tag to be attached to an object to be tackled. The tag`s antenna picks up the signals from an RFID reader or scanner and then returns the signal, usually with some additional data (like a unique serial number or other customized information).RFID tag can be very small-the size of a large rice grain. The two types of tag are

1. Active Tag
2. Passive Tag

### 2.3.1 Active Tag

An RFID tag is a passive tag when it is equipped with 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.

**The Major Advantages of Active RFID Tag are:**

a) It can be read at distances of one hundred feet or more, greatly improving the utility of this device.
b) It may have other sensors that can use electricity for power.

**The Problems and Disadvantages of an Active RFID Tag are:**

a) The tag cannot function without battery power, limited lifetime.
b) The tag is typically more expensive, often costing $20 or more.
c) The tag is physically larger, which may limit applications.
d) Battery outages in an active tag can result in expensive misreads.

**Active RFID tags may have all or some of the following features:**

a) Longest communication range of any tag.
b) The capability to perform independent monitoring and control.
c) The capability of initiating communications.
d) The highest data bandwidth.
e) Active may even be equipped with autonomous networking
f) The tags autonomously determine the best communication path.

### 2.3.2 Passive Tag

A passive tag is an RFID tag that does not contain a battery; the power is supplied by the reader. When the radio waves from the reader are encountered by passive RFID tag, the coiled antenna within the tag forms a magnetic field. The tag draws power from it, energizing the circuits in the tag. The tag then sends the information encoded in the tag`s memory.

**The Major Advantages of Passive RFID Tags are:**

a) The Tag functions without battery; these tags have a lifetime of over twenty years.
b) The Tag is typically much less expensive to manufacture.
c) The Tag is much smaller. These tags have almost unlimited applications in consumer goods and areas.

**The Major Disadvantages of Passive RFID Tags are:**

a) The tag can read only at very short distances typically a few feet at most. This greatly limits the device for certain applications.
b) It may not-be possible to include sensors that can use electricity for power.
c) The tag remains readable for a very long time, even after the product to which the tag is attached has been sold and is no longer being tracked.

## 2.4 IMPORTANT TERMS AND COMPONENTS

### 2.4.1 Antenna

The Antenna in an RFID tag is a conductive element that permits the tag to exchange data with the reader. Passive RFID tags make use of a coiled antenna that can create a magnetic field using the energy provided by the reader`s carrier signal.

### 2.4.2 Back Scatter

RFID tags sometimes make use of a method of communication called back scatter .Tags using back scatter technology reflect the reader`s signal right back, modulating the signal to transmit data.

### 2.4.3 Smart Card

It is another way to refer to a contact less smart card. This term refers to identification cards that do not need to make contact with the reader to be read, or swiped in a special slot. This capability is implemented using a tiny RFID tag in the card, intend is to provide the user with greater convenience by speeding checkout or authentication processes.

### 2.4.4 Transponder

An RFID transponder is a special kind of radio transmitter and receiver. It is activated when it receives a signal of specific kind. RFID transponders are present in smart cards and RFID`s.

### 2.4.5 Reader

An RFID reader is a device that is used to interrogate an RFID tag. The reader has 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 placement of the tag on the object to be identified will all have an impact on RFID system read range.

### 2.4.6 Error Correcting Code (ECC) & Error correcting Protocol

When the product of data is placed on an RFID tag, a special piece of data called an error correcting codes is created based on the product data using a known algorithm. The algorithm used to create the correcting code is called the error correcting protocol. When the tag is activated and read the reader pulls out the product data as well as ECC. The reader uses the error correcting protocol on the product data and compares the result to the ECC. Similar methods are used in most data transfer systems to ensure the correctness of each data packet as it moves from one part of the system to the other. A reader that performs this check automatically is said to be in error correcting codes.

## 2.5 RFID APPLICATIONS

Radio frequency Identification has many applications because of its efficient and cheap service. A lot of research is being done to find better uses of this technology. Some of the applications of the RFID are discussed below:

### 2.5.1 RFID & Asset Management

RFID combined with mobile computing and web technologies provide an efficient way for organization to identify and manage their assets. Mobile computers with integrated RFID readers can now deliver a complete set of tools that eliminate paperwork, give positive proof of identification. Errors are virtually eliminated as this approach removes manual data entry. Web based management tool allow organization to monitor their asset and make management decision from anywhere in the world. Web based application now mean that third parties, such as manufacturers and contractors can be granted to access to update asset data, including for example, inspection history and transfer documentation online ensuring that the end user always has accurate, real-time data. Organization within the plant industry are already using RFID tags combined with a mobile asset management solution to record and monitor the location of their assets, their current status, whether they have been maintained and most importantly if they comply with HES regulations. Fitter within depots and those working remotely on project/client sites use mobile computers to complete and record job instructions. These completed work records are then synchronized with a web based database allowing support and administration staff to respond accordingly.

### 2.5.2 Transportation & Logistics

Logistics and transportation is a major area of implementation for RFID technology. For example yard management, shipping, freight and distribution centres are some area where RFID tracking technology is used. Transportation companies around the world value RFID technology due to its impact on the business value and efficiency.

The North American railroad industry operates an automatic equipment identification system based on RFID. Locomotive and rolling stock are equipped with two passive RFID tags; the data encoded on tag identifies the equipment owner, car number, type of equipment, number of axels etc. The equipment number and car number cab be used to derive further data about the physical characteristics of the equipment from the association of American Railroad's car inventory database and railroad's own database indicating the lading, origin, destination etc of the commodities being carried.

Baggage passing through the Hong Kong international airport is individually tagged with "HKIA" RFID tags as they navigate the airport's baggage handling system, which improves efficiency and reduce misplaced items.

### 2.5.3 Human Implants

Implantable RFID chips designed for animal tagging are now being used in human. An experiment with RFID implants was conducted by British professor of cybernetics Kevin Warwick, who implanted a chip in his arm in 1998. In 2004

Conrad Chase offered implemented chips in his night club in Barcelona, Spain and in Rotterdam, the Netherlands, to identify their VIP customers, who in turn use it to pay for drinks.

In 2004, the Mexican Attorney General's office implemented 18 of its staff members with the Verichip to control access to a secure data room.
Security experts have warned against using RFID for authentication people due to the risk of identity theft. For instance a man-in-the-middle attack would make it possible for an attacker to steal the identity of a person in real time. Due to the resource constraints of RFIDs it is virtually impossible to protect against such attack models as this would require complex distance-binding protocols.

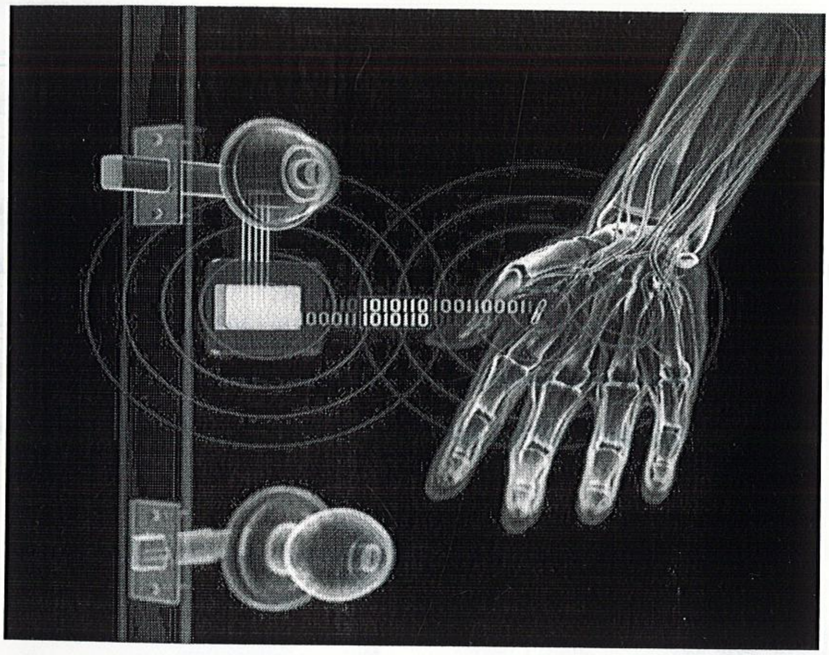


**Fig 2.5.3 Hand RFID Implant**

### 2.5.4 Libraries

RFID (Radio Frequency Identification) is the latest technology to be used in library theft detection systems. Unlike EM (Electro-Mechanical) and RF (Radio Frequency) systems, which have been used in libraries for decades, RFID-based systems move beyond security to become tracking systems that combine security

With more efficient tracking of materials throughout the library, including easier and faster charge and discharge, inventorying, and materials handling RFID is a combination of radio-frequency-based technology and microchip technology. The information contained on microchips in the tags affixed to library materials is read using radio frequency technology regardless of item orientation or alignment (i.e., the technology does not require line-of-sight or a fixed plane to read tags as do traditional theft detection systems) and distance from the item is not a critical factor except in the case of extra-wide exit gates. The corridors at the building exit(s) can be as wide as four feet because the tags can be read at a distance of up to two feet by each of two parallel exit sensors.

The targets used in RFID systems can replace both EM or RF theft detection targets and barcodes.

Six Things about RFID for Library

1. RFID tags replace both the EM security strips and Barcode.
2. Simplify patron self check-out / check-in.
3. Ability to handle material without exception for video and audio tapes.
4. Radio Frequency anti-theft detection is innovative and safe.
5. High-speed inventory and identify items which are out of proper order.
6. Long-term development guarantee when using Open Standard

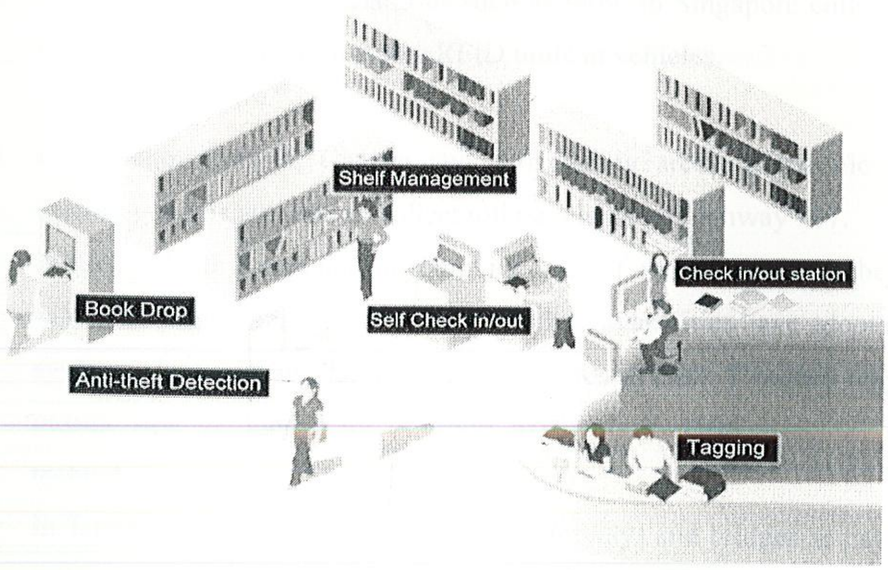



**Fig 2.5.4 RFID Library Management**

### 2.5.5 Social Retailing

When customers enter a dressing room, the mirror reflects their images and also images of apparel item being worn by celebrities on an interactive display. A webcam also projects an image of the consumer wearing the item on the website, for everyone to see. This creates an interaction between the consumer inside the store and their social network outside the store. The technology in this system is a RFID interrogator antenna in the dressing room and Electronic Product Code RFID tags on the apparel item.

### 2.5.6 Transportation Payments

RFID is being used for e-tolling in motorways, Dubai, implemented by NADRA. Throughout Europe , and in particular in Paris, Lyon, Bordeaux, Nancy and Marseilles in France, in the whole of Portuguese highways system and in many Portuguese public car parks, Milan, Turin, and Florence in Italy and Brussels in Belgium, RFID passes confirming to the Calypso(RFID) international standardise used for public transport system. They are also used now in Canada (Montreal), Mexico, Israel, Bogotá and Pereira in Columbia, Stavanger in Norway, Luxembourg etc.

- Electronic Road Pricing Gantries such as those in Singapore collect tolls in high-traffic areas from active RFID units in vehicles.

- In Toronto, Ontario, Canada and surrounding areas, Electronic Road Pricing systems are used to collect toll payments on highway 407.
- In Seoul, South Korea and surrounding cities, T-money cards can be used to pay for public transit. Some other South Korean cities have adopted the system, which can also be used in some stores as cash. T-money replaced passes, first introduced for transport payments in 1996 using MIFARE technology.
- In Turkey, RFID has been used in the motorways and bridges as payment system over ten years. Is in also used in electronics bus ticket in Istanbul.

- In Hong Kong mass transit is paid for almost exclusively through the use of RFID technology, called octopus card. Originally it was launched in September 1997 exclusively for transit fare collection, but has grown to be similar to a cash card and still be used in vending machine, fast-food restaurants and supermarkets. The card can be recharge with cash at add-value machines or in shops and can be read several centimetres from the readers. The same applies for Delhi Metro, the rapid transit system in New Delhi.
- The Moscow Metro, the world's second busiest, was the first system in Europe to introduced RFID as a smart card in 1998.

## 2.6 POTENTIAL USES

RFID can be used in variety of application such as

- Access management.
- Tracking of goods and RFID in retail.
- Tracking of persons and animals.
- Toll collection and contactless payments.
- Machine readable travel documents.
- Smart dust (for massively distributed sensor networks).
- Location based services.
- Tracking sports memorabilia to verify authenticity.

## 2.7 COMPARISON TO BARCODE TECHNOLOGY

The technology commonly used earlier for purposes like object identification was bar code technology. This was a line of sight technology. RFID can be called the far better and advanced version of barcode technology.

It offers many more features than barcode or other previously used technology, now the technology is on extensive side at the moment but with recent advancement manufactures have been able to cut off cost and the technology is becoming hugely popular with its various benefits.

| RFID | BARCODE |
|---|---|
| Counterfeiting is difficult. | Counterfeiting is essay. |
| Scanner not required. No need to bring the tag near the code. | Scanner is required to see the bar code to read it. |
| RFID is fast comparatively. | Bar code technology is slow. |
| Can read multiple tags. | Can read only one tag at a time. |
| Can be reused within factory premises. | Cannot be reused. |

**Table 2.7 Comparison of RFID and Barcode Technology**

Because radio waves are used to sense the tag, RFID has the advantage that no line-of –sight alignment is required between the RFID tags and the reader. What this mean is that the RFID reader can read the multiples tags simultaneously and instantly. The tags may be embedded inside an object such as a container or garments. Furthermore RFID tags can store a lot more of information than barcode's.

Imagine a big carton with hundreds of shirts of different sizes and colours, each tagged with RFID. The moment the carton reached the warehouse or the store, the RFID reader immediately identifies all the tags and information about the inventory such as the number of shirts, type, size, colour etc, is instantly available on the computer screen, without even open the carton.

## 2.8 RFID GAINING POPULARITY

Interest in RFID is on the rise, according to the survey conducted by the Computing Technology Industry Association (CompTIA). The worldwide survey of 155 IT companies found that 46% of their customers have implemented one or more RFID solutions, either as pilot project or production deployment. This represent a 12% jump over 2007-2008, when IT companies reports 34% of their customer had initiated RFID projects.

The most popular RFID deployment, according to the survey, are Asset Tracking (32%), Personal Identification (28%), Supply Chain (25%), Retail Marketing (15%), and Closed Loop Manufacturing (9%) according to CompTIA survey.

## Chapter 3

# HARDWARE DESCRIPTION

## 3.1 RFID READER

Radio Frequency Identification (RFID) Card Readers provide a low-cost solution to read passive RFID transponder tags up to 7 cm away. This RFID Card Reader can be used in a wide variety of hobbyist and commercial applications, including access control, automatic identification, robotics navigation, inventory tracking, payment systems, and car immobilization. The RFID card reader read the RFID tag in range and outputs unique identification code of the tag at baud rate of 9600. The data from RFID reader can be interfaced to be read by microcontroller or PC.

### 3.1.1 Features & Specifications

- Low-cost method for reading passive RFID transponder tags.
- 9600 bps serial interface at 5V TTL level for direct interface to microcontrollers
- Buzzer & LED indicate valid RFID Tag detection
- Range up to 7 cm for 125 KHz RFID Cards or Key chains

| Parameter | Value |
|---|---|
| Input Voltage | 5V DC regulated |
| Output Data Speed | 9600 BPS<br>8 Bit Data/No-Parity/1 Stop Bit |
| Output Data Level | 5V TTL level |
| Detection Range | 7 cm contact-less |
| Valid Tag in Range | Indicated by Buzzer and LED |

**Table 3.1.2 Specification of Reader**

### 3.1.2 Information & Communication

Each transponder tag contains a unique identifier (one of 2, or 1,099,511,627,776 possible combinations) that is read by the RFID Card Reader and transmitted to the host via a simple serial interface.

When the RFID Card Reader is active and a valid RFID transponder tag is placed within range of the activated reader, the unique ID will be transmitted as a 12-byte printable ASCII string serially to the host in the following format:

| Start Byte (0x0A) | Unique ID Digit 1 | Unique ID Digit 2 | Unique ID Digit 3 | Unique ID Digit 4 | Unique ID Digit 5 | Unique ID Digit 6 | Unique ID Digit 7 | Unique ID Digit 8 | Unique ID Digit 9 | Unique ID Digit 10 | Stop Byte (0x0D) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**Fig 3.1.2 Communication in RFID**

The start byte and stop byte are used to easily identify that a correct string has been received from the reader (they correspond to a line feed and carriage return characters, respectively). The middle ten bytes are the actual tag's unique ID.

For example, for a tag with a valid ID of 0F0184F07A, the following ASCII data would be sent 0F0184F07A.

Same data in HEX bytes can be interpreted as:

0x0A, 0x30, 0x46, 0x30, 0x31, 0x38, 0x34, 0x46, 0x30, 0x37, 0x41, 0x0D

All communication is 8 data bits, no parity, 1 stop bit, and least significant bit first (8N1). The baud rate is configured for 9600 bps, a standard communications speed supported by most any microprocessor or PC, and cannot be changed. The RFID Card Reader initiates all communication. This allows easy access to the serial data stream from any programming language that can open a COM port.

### 3.1.3 Using RFID Reader

When powered on the RFID reader will activate a RF field waiting for a tag to come into its range. Once tag is detected, its unique ID number is read and data is sent via serial interface. The valid tag detecting is indicated by LED blink and Buzzer beep. The face of the RFID tag should be held parallel to the front of the antenna (where the majority of RF energy is focused). If the tag is held sideways (perpendicular to the antenna) you may have difficulty getting the tag to be read. Only one transponder tag should be held up to the antenna at any time. The use of multiple tags at one time will cause tag collisions and confuse the reader. The tags available with us have a read distance of approximately 7 cm. Actual distance may vary slightly depending on the size of the transponder tag and environmental conditions of the application.

### 3.1.4 Connecting to Microcontroller

Connect data output pin of RFID reader to RXD pin of any microcontroller and configure your MCU to receive data at 9600baud rate. You also have to keep common ground signal between RFID reader and microcontroller.

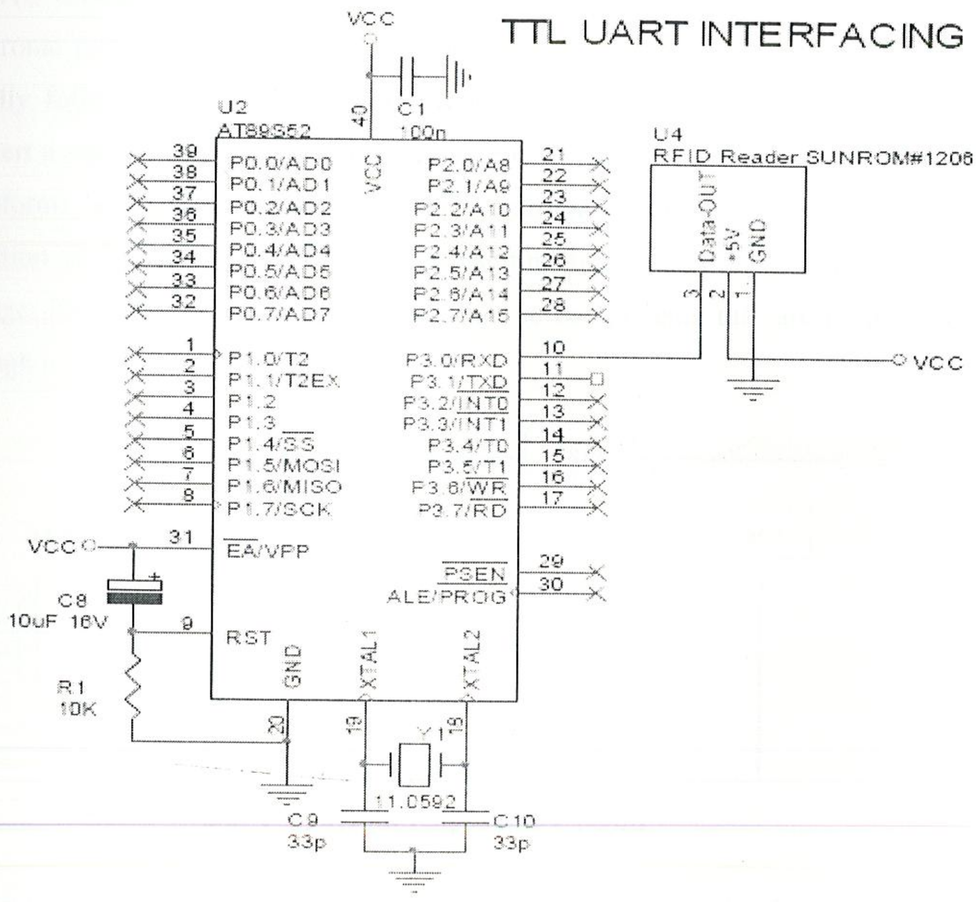



Fig 3.1.4 Interfacing of Reader to Microcontroller

## 3.2 POWER SUPPLY UNIT

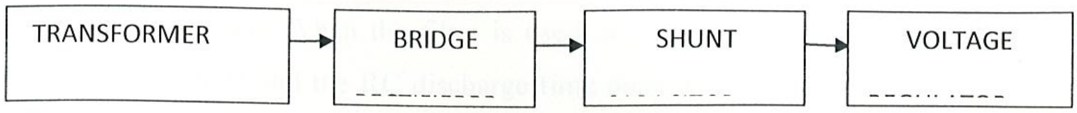



**Fig 3.2a Power Supply Unit Block Diagram**

The transformer steps down the 220 V AC into 12 V AC. The transformer work on the principle of magnetic induction, where two coils: primary and secondary are wound around an iron core. The two coils are physically insulated from each other in such a way that passing AC current through the primary coil creates a changing voltage in the primary coil and a changing magnetic field in the core. This in turn induces a varying AC voltage in the secondary coil.

The AC voltage is then fed to the bridge rectifier. The rectifier circuit is used in most electronic power supplies is the single-phase bridge rectifier with capacitor filtering, usually followed by a linear voltage regulator. A rectifier circuit is necessary to convert a signal having zero average value into a non-zero average value. A rectifier transforms alternating current into direct current by limiting or regulating the direction of flow of current. The output resulting from a rectifier is a pulsating D.C. voltage. This voltage is not appropriate for the components that are going to work through it.

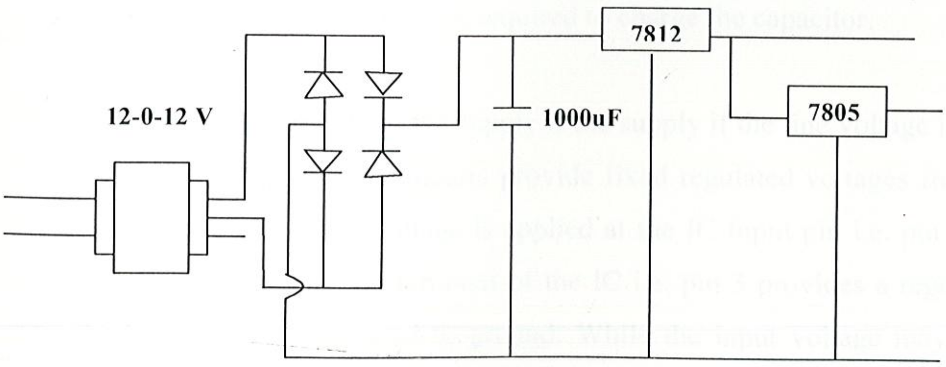



**Fig 3.2b 5-Volt Generator Circuit**

The ripple of the D.C. voltage is smoothened using a filter capacitor of 1000 micro Farad 25V. The filter capacitor stores electrical charge. If it is large enough the capacitor will store charge as the voltage rises and give up the charge as the voltage falls. This has the effect of smoothing out the waveform and provides steadier voltage output. A filter capacitor is connected at the rectifier output and the DC voltage is obtained across the capacitor. When this capacitor is used in this project, it should be twice the supply voltage. When the filter is used, the RC charge time of the filter capacitor must be short and the RC discharge time must be long to eliminate ripple action. In other words the capacitor must charge up fast, preferably with no discharge.

When the rectifier output voltage is increasing, the capacitor charges to the peak voltage Vm. Just past the positive peak, the rectifier output voltage starts to fall but at this point the capacitor has +Vm voltage across it. Since the source voltage becomes slightly less than Vm, the capacitor will try to send current back through the diode of rectifier. This reverse biases the diode. The diode disconnects or separates the source the source form load. The capacitor starts to discharge through load. This prevents the load voltage from falling to zero. The capacitor continues to discharge until source voltage becomes more than capacitor voltage. The diode again starts conducting and the capacitor is again charged to peak value Vm. When capacitor is charging the rectifier supplies the charging through capacitor branch as well as load current, the capacitor sends currents through the load. The rate at which capacitor discharge depends upon time constant RC. The longer the time constant, the steadier is the output voltage. An increase in load current i.e. decrease in resistance makes time constant of discharge path smaller. The ripple increase and DC output voltage V dc decreases. Maximum capacity cannot exceed a certain limit because the larger the capacitance the greater is the current required to charge the capacitor.

The voltage regulator regulates the supply if the supply if the line voltage increases or decreases. The series 78xx regulators provide fixed regulated voltages from 5 to 24 volts. An unregulated input voltage is applied at the IC Input pin i.e. pin 1 which is filtered by capacitor. The out terminal of the IC i.e. pin 3 provides a regular output. The third terminal is connected to ground. While the input voltage may vary over some permissible voltage range, and the output voltage remains constant within specified voltage variation limit. The 78xx IC's are positive voltage regulators whereas 79xx IC's are negative voltage regulators.

These voltage regulators are integrated circuits designed as fixed voltage regulators for a wide variety of applications. These regulators employ current limiting, thermal shutdown and safe area compensation. With adequate heat sinking they can deliver output currents in excess of 1 A. These regulators have internal thermal overload protection. It uses output transistor safe area compensation and the output voltage offered is in 2% and 4% tolerance.

## 3.3 LIQUID CRYSTAL DISPLAY

### 3.3.1 Introduction

Liquid crystal displays (LCD) are widely used in recent years as compares to LEDs. This is due to the declining prices of LCD, the ability to display numbers, characters and graphics, incorporation of a refreshing controller into the LCD, their by relieving the CPU of the task of refreshing the LCD and also the ease of programming for characters and graphics. HD 44780 based LCDs are most commonly used.

### 3.3.2 LCD Pin Description

The LCD discuss in this section has the most common connector used for the Hitachi 44780 based LCD is 14 pins in a row and modes of operation and how to program and interface with microcontroller is describes in this section.

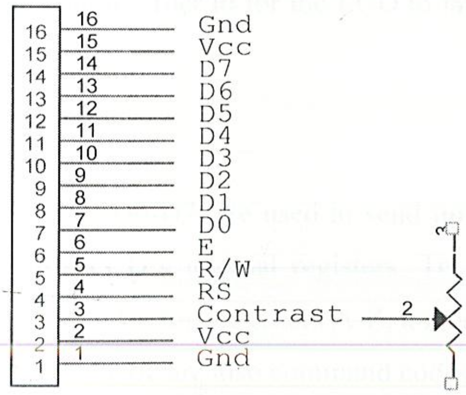



**Fig 3.3.2a LCD Pin Description Diagram**

**$V_{CC}$, $V_{SS}$, $V_{EE}$**

The voltage $V_{CC}$ and $V_{SS}$ provided by +5V and ground respectively while $V_{EE}$ is used for controlling LCD contrast. Variable voltage between Ground and Vcc is used to specify the contrast (or "darkness") of the characters on the LCD screen.

**RS (Register Select)**

There are two important registers inside the LCD. The RS pin is used for their selection as follows. If RS=0, the instruction command code register is selected, then allowing to user to send a command such as clear display, cursor at home etc.. If RS=1, the data register is selected, allowing the user to send data to be displayed on the LCD.

**R/W (Read/Write)**

The R/W (read/write) input allowing the user to write information from it. R/W=1, when it read and R/W=0, when it writing.

**EN (Enable)**

The enable pin is used by the LCD to latch information presented to its data pins. When data is supplied to data pins, a high power, a high-to-low pulse must be applied to this pin in order to for the LCD to latch in the data presented at the data pins.

**D0-D7 (Data Lines)**

The 8-bit data pins, D0-D7, are used to send information to the LCD or read the contents of the LCD's internal registers. To displays the letters and numbers, we send ASCII codes for the letters A-Z, a-z, and numbers 0-9 to these pins while making RS =1. There are also command codes that can be sent to clear the display or force the cursor to the home position or blink the cursor.

We also use RS =0 to check the busy flag bit to see if the LCD is ready to receive the information. The busy flag is D7 and can be read when R/W =1 and RS =0, as follows: if R/W =1 and RS =0, when D7 =1(busy flag =1), the LCD is busy taking care of internal operations and will not accept any information. When D7 =0, the LCD is ready to receive new information. LCD when connected to an ATMEL microcontroller.

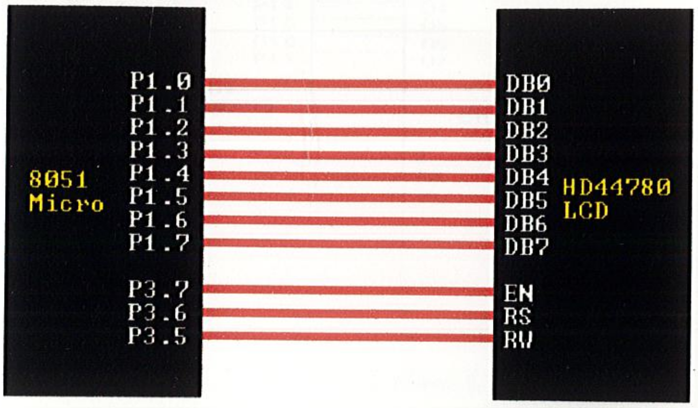



**Fig 3.3.2b LCD Pin Description Diagram**

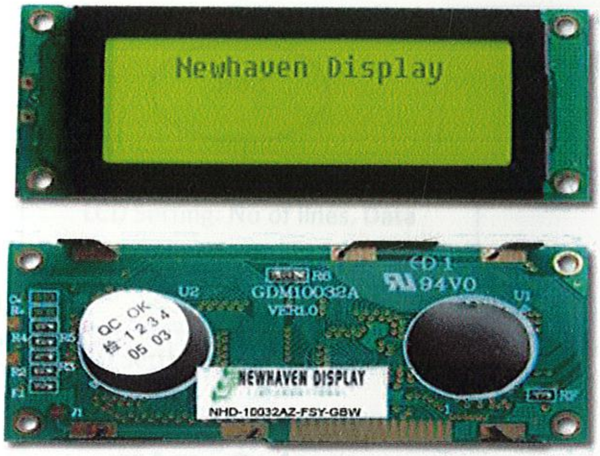



**Fig 3.3.2c LCD Display Panel**

### 3.3.3 Interfacing of LCD Display with Microcontroller

The LCD can be easily interfaced with the microcontroller. For that we connect port lines with the pins of LCD. In this example RS of the LCD is connected with the P3.5.RW of the LCD is connected with the P3.3 EN of LCD is connected with P3.4. Data line of the LCD is connected with the P1 of MC.

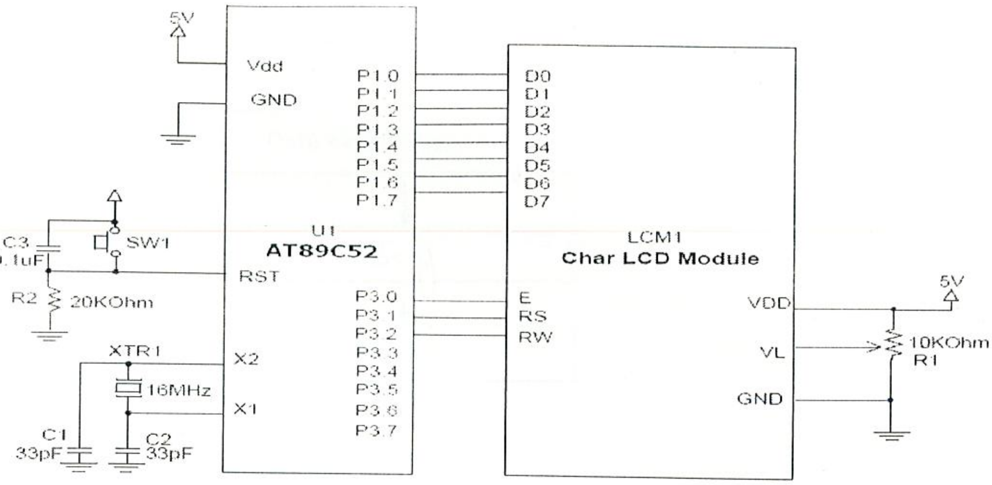
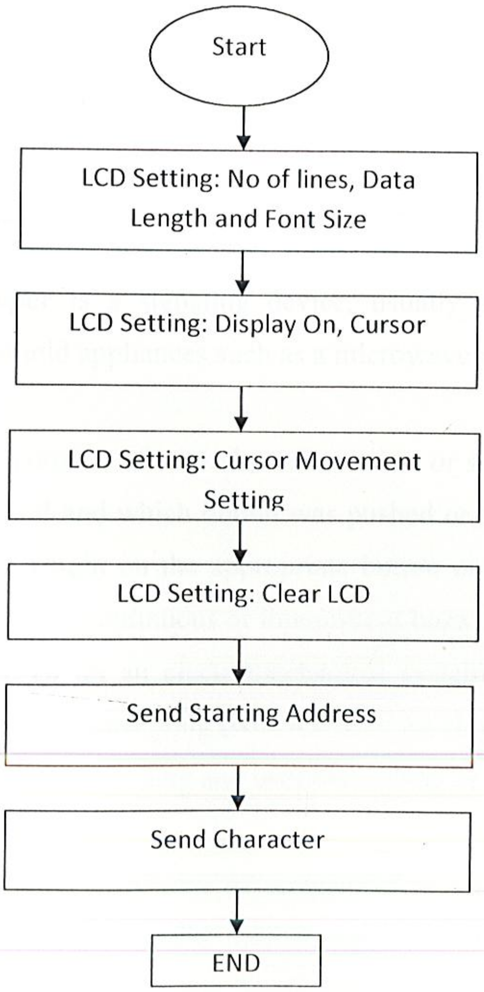
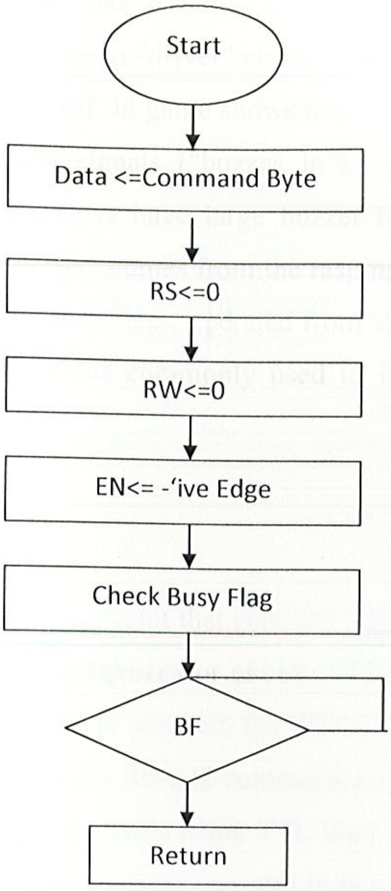



**Fig 3.3.3 LCD Interface Circuit**

### 3.3.4 LCD Interfacing Flowcharts






## 3.4 BUZZER

A **buzzer** or **beeper** is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows.

It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board.

Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramicbased piezoelectric counter like a Sonar alert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off. In game shows it is also known as a "lockout system," because when one person signals ("buzzes in"), all others are locked out from signaling. Several game shows have large buzzer buttons which are identified as "plungers". The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles. Other sounds commonly used to indicate that a button has been pressed are a ring or a beep.

## 3.5 MAX 232

The MAX232 is an electronic circuit that converts signals from a serial port to signals suitable for usage in e.g. microprocessor circuits. When communicating with various micro processors one needs to convert the RS232 levels down to lower levels, typically 3.3 or 5.0 Volts. Serial RS-232 communication works with voltages -15V to +15V for high and low. On the other hand, TTL logic operates between 0V and +5V. Modern low power consumption logic operates in the range of 0V and +3.3V or even lower. Thus the RS-232 signal levels are far too high TTL electronics, and the negative RS-232 voltage for high can't be handled at all by computer logic. To receive serial data from an RS-232 interface the voltage has to be reduced. Also the low and high voltage level has to be inverted. The level converter uses a Max232 and five capacitors. The Pin Out diagram of the chip MAX 232 is as shown below:

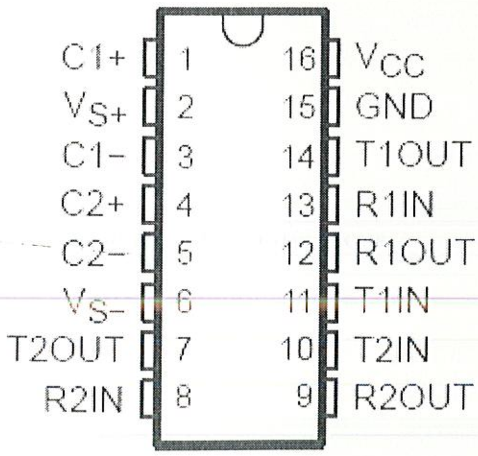



**Fig 3.5a MAX-232 Pin-out**

This chip has two pairs of TxD and RxD lines. The chip is required to connect the electrolytic capacitors of 22 µf, 16V with pins. It also eliminated the need of capacitor.

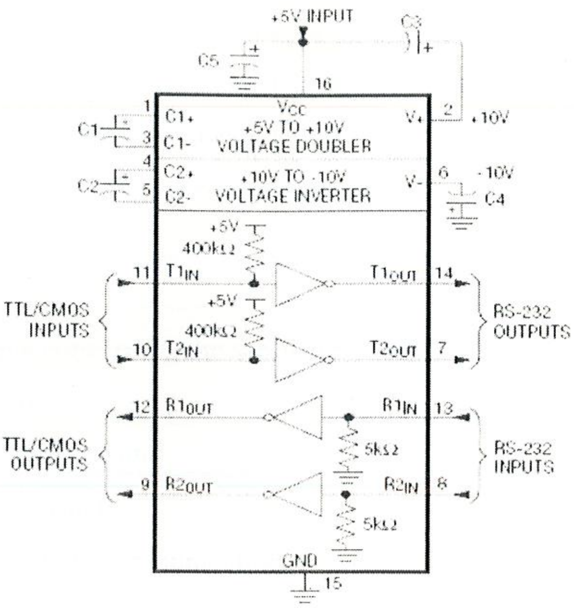



**Fig 3.5b MAX-232 Internal Schematic**

### 3.5.1 Applications

- Portable Computers
- Low-Power Modems
- Interface Translation
- Battery-Powered RS-232 Systems
- Multi-drop RS-232 Networks

### 3.5.2 Features

- Superior to bipolar.
- Low-power receive mode in shutdown.
- Meet all EIA/TIA-232E and v.28 specifications.
- 3-State Driver and Receiver Output.

## 3.6 RS-232 SERIAL INTERFACE

Within a microcomputer data is transferred in parallel, because that is the fastest way to do it. For transferring data over long distances, however, parallel data transmission requires too many wires. Therefore, data to be sent long distances is usually converted from parallel form to serial form so that it can be sent on a single wire or pair of wires. Serial data received from a distant source is converted to parallel form so that it can be easily transferred on the microcomputer buses.

### ❖ Serial Interface

Basic concepts concerning the serial communication can be classified into categories below:

- Interfacing requirements
- Transmission format
- Error check in data communication
- Standards in serial I/O

### ❖ Interfacing Requirements

The serial interface requirement is very much similar to parallel interface requirement. Computer identifies the peripheral through port address and enable if using the read and write signals. The primary difference between the parallel I/O and serial I/O is the number of lines used for data transfer. Parallel I/O requires the entire bus while the serial I/O requires only one or pair of data lines for communication.

### I. Transmission Format

Transmission format for communication is concerned with the issues such as synchronization, direction of data flow, speed, errors and medium of transmission. Serial data can be sent synchronously or asynchronously.

### II. Synchronous Data Transmission

For synchronous data transmission data is sent in blocks at a constant rate. The start and end of the block are identified with specific bytes or bit patterns.

### III. Asynchronous Data Transmission

For asynchronous transmission each data character has a bit which identifies its start and 1 or 2 bits, which identifies its end. Since each character is individually identified, characters can be sent at any time (asynchronously), in the same way that a person types on a keyboard.

The asynchronous format is character oriented. Each character carries the information of the start and stop bits. When no data is being transferred ,a receiver stage high at the logic 1 called mark; logic 0 is called space. The transmission of data begins with one start bit (low) followed by a character and one or two stop bits (high). This is known as framing. The asynchronous format is generally used in low speed transmission (less than 20k bits/sec) in serial I/O one bit is sent out at a time. Therefore how long the bit stays on or off is determined by the speed at which bits are transmitted. The receiver should be set up to receive the bits at the same rate of transmission; otherwise the receiver may not be able to differentiate between the two consecutive 0s and 1s.

The rate at which the bits are transmitted (bits/sec) is called baud. Each equipment has its own baud requirements. The figure shown below shows how the ASCII characters A (41) will be transmitted with the 1200 baud with the framing information of one start and one stop bit. The bit time (delay between any two successive bits) is 0.83ms; this is determined by the baud as follows.

### IV. Error Check In Data Communication

During transmission, various types of errors can occur. These errors need to be checked, therefore, additional information for error checking is sent during transmission the receiver can check the received data against the error check information, and if the error is detected, the receiver can request there retransmission of that data segment. Three methods generally used for this purpose are parity check, checksum and redundancy check.

### V. Standard in Serial I/O

The serial I/O technique is commonly used to interface terminals, printers etc. a standard is normally defined by a professional organization (such as IEEE). A standard may include such items as assignment of pin positions for signals, voltage levels, speed of data transfer, length of cable and mechanical specifications. When data are transmitted as voltage, the commonly used standard is known as RS232C. it is defined as reference to data terminal equipment (DTE) and data communication equipment (DCE). The rate of transmission is RS232C is restricted to a maximum of 20k baud and a distance of 50 feet. The pin connections for Rs 232 are as shown below:

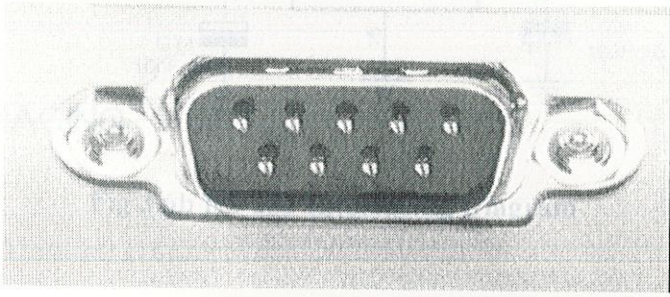


**Fig 3.6a Serial Port**

| | **9 Pin Connector on a DTE device (PC connection)** |
|---|---|
| Male RS232 DB9 |  |
| **Pin Number** | **Direction of signal:** |
| 1 | Carrier Detect (CD) (from DCE) Incoming signal from a modem |
| 2 | Received Data (RD) Incoming Data from a DCE |
| 3 | Transmitted Data (TD) Outgoing Data to a DCE |
| 4 | Data Terminal Ready (DTR) Outgoing handshaking signal |
| 5 | Signal Ground Common reference voltage |
| 6 | Data Set Ready (DSR) Incoming handshaking signal |
| 7 | Request To Send (RTS) Outgoing flow control signal |
| 8 | Clear To Send (CTS) Incoming flow control signal |
| 9 | Ring Indicator (RI) (from DCE) Incoming signal from a modem |

**Table 3.6 Pin Connections for 9 Pin Connectors**

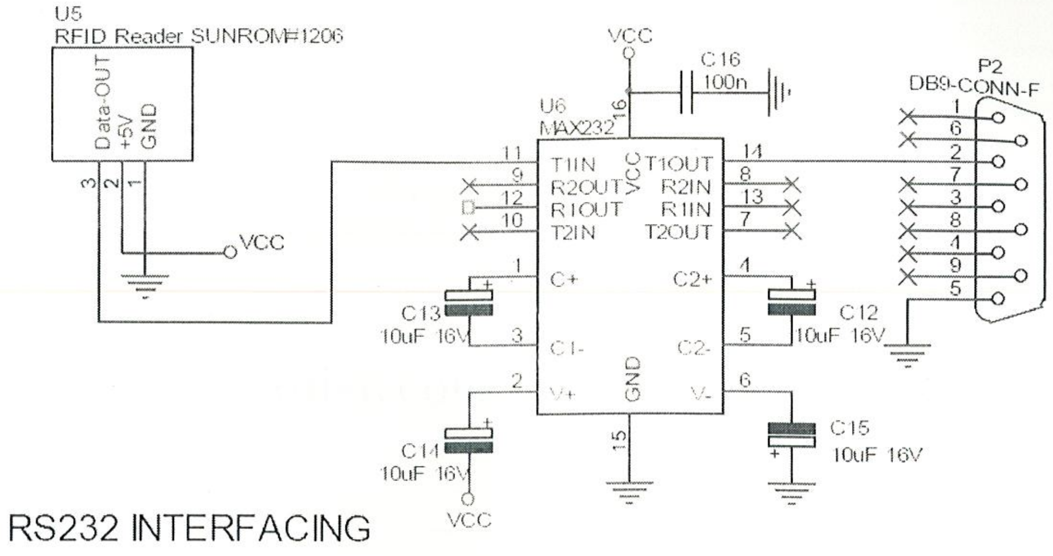



**Fig 3.6b RS-232 Interfacing Diagram**

## Chapter 4

# SOFTWARE

### 4.1 PROGRAMMING CODE

```
#define s1 P20
#define s2 P21
#define s3 P22
#define buzz P23
#include<lcdrout.h>
unsigned char entry=0,rfid_temp[10]={32,32,32,32,32,32,32,32,32,32};
unsigned int b1[5]={0,0,0,0,0};
unsigned int b2[5]={0,0,0,0,0};
unsigned int b3[5]={0,0,0,0,0};
unsigned int b4[5]={0,0,0,0,0};
unsigned int b5[5]={0,0,0,0,0};
char count[5];
//////////////FOR SERIAL COMMUNICATION
unsigned char i=0;
bit clr=0;
//void show_data_time(unsigned char);
void serial (void)  interrupt 4
{
        if(TI==1)
                TI=0;
        else
                {
                RI=0;
                if(SBUF!=2 && SBUF!=13 )
                {
```

```
                rfid_temp[i]=SBUF;
                i++;
                }
                if(i>9)
                        entry=1;
                }
} /*
found_book(char x)
{
 char n;
 n=0;
 if(x==0)
 {
        while(n<5)
        {
//                  if(bshelf[n][m]==0)
                    {
                         break;
                    }
                         n++;
        }
        return(n);
 }
} */
unsigned int assign()
{
unsigned int val;
        secdelay(1);
        while(1)
        {

        lcd_cmd1(0x80);
        lcd_puts("Waiting");
```

```
        if(entry==1)
        {       clrscr();
                //lcd_puts("ID No.");
                //displaypval(i);
                //lcd_cmd1(0xc0);
                //lcd_display(rfid_temp,10);
                //secdelay(2);
                //entry=0;
                //clrscr();
                i=0;
                break;
        }
        }
        val=rfid_temp[9]-48;
        val=val*(rfid_temp[10]-48);
        return(val);
}
unsigned char  chk_book(unsigned int id,bit k)
{
                unsigned char chk_ind=0;
                if(k==0)
                {
                        clrscr();
                 lcd_puts("Matching Stock.. ");
                 secdelay(1);
                        chk_ind=0;
                        while(chk_ind<5)
                        {
                         if(b1[chk_ind]==id)
                            {
                             count[1]--;
                             b1[chk_ind]=0;
                             return(10+chk_ind);
```

```
                goto out;
              }
     chk_ind++;
    }
    chk_ind=0;
    while(chk_ind<5)
    {
     if(b2[chk_ind]==id)
              {
count[2]--;
                b2[chk_ind]=0;
                return(20+chk_ind);
                goto out;
              }
     chk_ind++;
    }
    chk_ind=0;
    while(chk_ind<5)
    {
     if(b3[chk_ind]==id)
              {
               count[3]--;
                b3[chk_ind]=0;
                return(30+chk_ind);
                goto out;
              }
     chk_ind++;
    }
    chk_ind=0;
    while(chk_ind<5)
    {
     if(b4[chk_ind]==id)
              {
```

```
                    count[4]--;
                    b4[chk_ind]=0;
                   return(40+chk_ind);
                   goto out;
                  }
              chk_ind++;
             }
             chk_ind=0;
             while(chk_ind<5)
             {
              if(b5[chk_ind]==id)
                  {
                   count[5]--;
                   b5[chk_ind]=0;
                   return(50+chk_ind);
                   goto out;
                  }
              chk_ind++;
             }
        return(0);
goto out;
        }
        else{
          clrscr();
          lcd_puts("Matching Stock.. ");
          secdelay(1);
             chk_ind=0;
             while(chk_ind<5)
             {
              if(b1[chk_ind]==id)
                         break;
              chk_ind++;
             }
```

```
if(chk_ind<5)
{
 return(1);
 goto out;
}
chk_ind=0;
while(chk_ind<5)
{
 if(b2[chk_ind]==id)
        break;
         chk_ind++;
}
if(chk_ind<5)
{
 return(2);
 goto out;
}
chk_ind=0;
while(chk_ind<5)
{
        if(b3[chk_ind]==id)
                        break;
        chk_ind++;
}
if(chk_ind<5)
{
 return(3);
 goto out;
}
chk_ind=0;
while(chk_ind<5)
{
        if(b4[chk_ind]==id)
```

```
                    break;
                     chk_ind++;
            }
            if(chk_ind<5)
            {
             return(4);
             goto out;
            }
            chk_ind=0;
            while(chk_ind<5)
            {
                    if(b5[chk_ind]==id)
                            break;
                    chk_ind++;
            }
            if(chk_ind<5)
            {
             return(5);
             goto out;
            }
            return(0);
            }
out: clrscr();
}
fill(unsigned int id,unsigned char bshelf)
{
unsigned char chk_ind=0,test;

        test=chk_book(id,1);
        if(test==0)
        {
          if(bshelf==1)
                {
```

```
if(count[1]<5)
{
        while(chk_ind<5)
        {
                if(b1[chk_ind]==0)
                        break;
                chk_ind++;
        }
        b1[chk_ind]=id;
        clrscr();
        lcd_puts("Checking");
        lcd_cmd1(0xc0);
        displaypval(b1[chk_ind]);
        secdelay(1);
}
else
{
 clrscr();
 lcd_puts("No Vaccancy");
 buzz=0;
 secdelay(1);
 buzz=0;
 secdelay(1);
}
}
if(bshelf==2)
{
 if(count[2]<5)
 {
        while(chk_ind<5)
        {
                if(b2[chk_ind]==0)
                        break;
```

```
                chk_ind++;
            }
            b2[chk_ind]=id;
            clrscr();
            lcd_puts("Checking");
            lcd_cmd1(0xc0);
            displaypval(b2[chk_ind]);
            secdelay(1);
}
else
{
 clrscr();
 lcd_puts("No Vaccancy");
 buzz=0;
 secdelay(1);
 buzz=0;
 secdelay(1);
 }
}
if(bshelf==3)
{
 if(count[3]<5)
 {
            chk_ind=0;
            while(chk_ind<5)
            {
                if(b3[chk_ind]==0)
                        break;
                chk_ind++;
                    }
            b3[chk_ind]=id;
            clrscr();
            lcd_puts("Checking");
```

```
                lcd_cmd1(0xc0);
                displaypval(b3[chk_ind]);
                secdelay(1);
  }
  else
  {
   clrscr();
   lcd_puts("No Vaccancy");
   buzz=0;
   secdelay(1);
   buzz=0;
   secdelay(1);
  }
}
if(bshelf==4)
{
 if(count[4]<5)
 {  while(chk_ind<5)
                {

                 if(b4[chk_ind]==0)
                                        break;
                       chk_ind++;
                }
                b4[chk_ind]=id;
                clrscr();
                lcd_puts("Checking");
                lcd_cmd1(0xc0);
                displaypval(b4[chk_ind]);
                secdelay(1);
}
else
{
```

```
clrscr();
lcd_puts("No Vaccancy");
buzz=0;
secdelay(1);
buzz=0;
secdelay(1);
}
}
if(bshelf==5)
{
 if(count[5]<5)
 {
            while(chk_ind<5)
            {
                  if(b5[chk_ind]==0)
                              break;
                  chk_ind++;
            }
            b5[chk_ind]=id;
            clrscr();
            lcd_puts("Checking");
            lcd_cmd1(0xc0);
            displaypval(b5[chk_ind]);
            secdelay(1);
 }
 else
 {
  clrscr();
  lcd_puts("No Vaccancy");
  buzz=0;
  secdelay(1);
  buzz=0;
  secdelay(1);
```

```
                    }
                  }
        count[bshelf]++;
        }
        else
        {
        clrscr();
        lcd_puts("Already member");
        lcd_cmd1(0xc0);
        lcd_puts("Of B No.:");
        displaypval(test);
        secdelay(2);
        clrscr();
        }
      }
///////////// Main Section
      void main(void)
      {
  unsigned int cid,val;
      unsigned char bno;
        lcd_initialize();
        ACC=0x80;
        lcd_cmd();
        lcd_puts("RFID Based Lib.");
        ACC=0xC0;
        lcd_cmd();
        lcd_puts("Manag. Sys.");
        secdelay(1);
        clrscr();
        TMOD =0x20;
        TH1 = 0xFD;
        SCON =0x50;
        IE=0x91;
```

```
TR1=1;
P1=P2=P3=P0=0xff;

while(1)
{       lcd_cmd1(0x80);
        lcd_puts("Greetings...");
        lcd_cmd1(0xc0);
        lcd_puts("Waiting");
        if(entry==1)
        {
                clrscr();
                //lcd_puts("ID No.");
                // displaypval(i);
                // lcd_cmd1(0xc0);
                 // lcd_display(rfid_temp,10);
                 // secdelay(2);
                  i=0;
                  entry=0;
                // clrscr();

                val=rfid_temp[9]-48;
                val=val*(rfid_temp[10]-48);
                //displaypval(val);
                bno=chk_book(val,1);
                if(bno==0)
                {
                 buzz=0;
                 clrscr();
                 lcd_puts("Not a Member Yet ");
                 secdelay(2);
                 buzz=1;
                 clrscr();
                }
```

```
else
{
 buzz=1;
 clrscr();
 lcd_puts("Belongs To ");
 lcd_cmd1(0xc0);
 lcd_puts("Shelf No. :");
 displaypval(bno);
 secdelay(2);
 buzz=1;
 clrscr();
}
i=0;
entry=0;
}

if(s1==0 || s2==0 ||s3==0)
{
s1=s2=s3=1;
clrscr();
lcd_puts("S1>Add S2>REM");
lcd_cmd1(0xc0);
lcd_puts("S3>> Cancel ");
while(s1==1 && s2==1 && s3==1 );

if(s1==0)
{
clrscr();
lcd_puts("Adding..");
cid=assign();
//lcd_cmd1(0xc0);
//displaypval(cid);
secdelay(2);
```

```
clrscr();
lcd_puts("Select Shelf No. ");
bno=1;
s1=s2=s3=1;
while(s3==1)
{
        if(s1==0)
        {
         bno++;
         if (bno>5)
                bno=1;
        }
    if(s2==0)
        {
         bno--;
         if (bno==0)
                bno=5;
        }
        lcd_cmd1(0xc0);
        displaypval(bno);
        ms_delay(250);
}

if(count[bno]<4)
{
    clrscr();
    lcd_puts("Vacancy:");
    displaypval(5-count[bno]);
    secdelay(1);
    clrscr();
    fill(cid,bno);
    lcd_puts(" ");
}
```

```
                else
                {
                        clrscr();
                        lcd_puts("No Space");
                        secdelay(2);
                }
        }
        if(s2==0)
        {
                clrscr();
                lcd_puts("Removing..");
                secdelay(1);
                clrscr();
                cid=assign();
                //lcd_cmd1(0xc0);
                //display2val(cid);
                //secdelay(2);
                //clrscr();
                cid=chk_book(cid,0);
                if(cid==0)
                {
                 clrscr();
                        buzz=0;
                        lcd_puts("Not a member yet");
                        secdelay(2);
                        buzz=1;
                        clrscr();
                }
                else
                {
                clrscr();
                lcd_puts("Removed From");
                lcd_cmd1(0xc0);
```

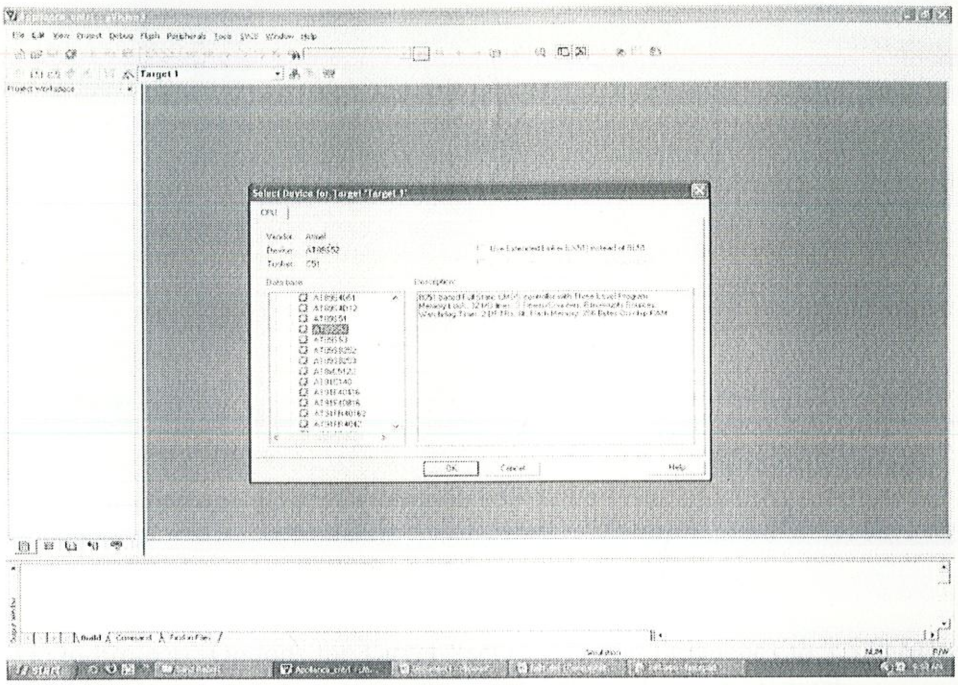
```
                lcd_puts("B No.");
                display2val(cid/10);
                lcd_puts(" Sh. No.");
                display2val((cid%10)+1);
                secdelay(2);
                clrscr();
                }
        }

if(s3==0)
        {
            clrscr();
            lcd_puts("Cancelling... ");
            secdelay(2);
            clrscr();
        }
        entry=0;
        i=0;
        clrscr();
    }
        }
}
```

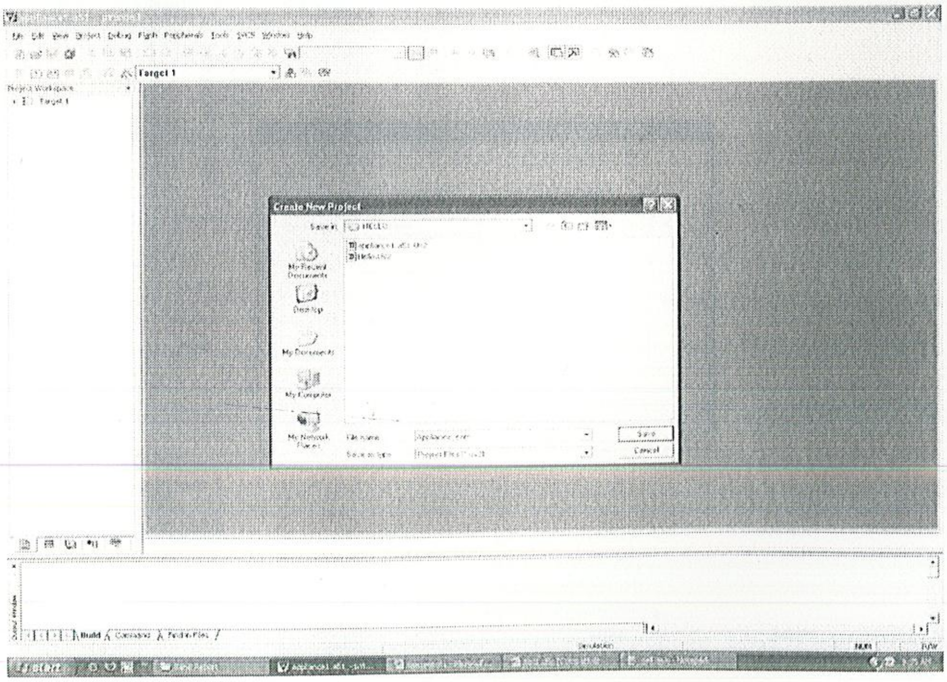
## 4.2 USING KEIL SOFTWARE

**Steps:**

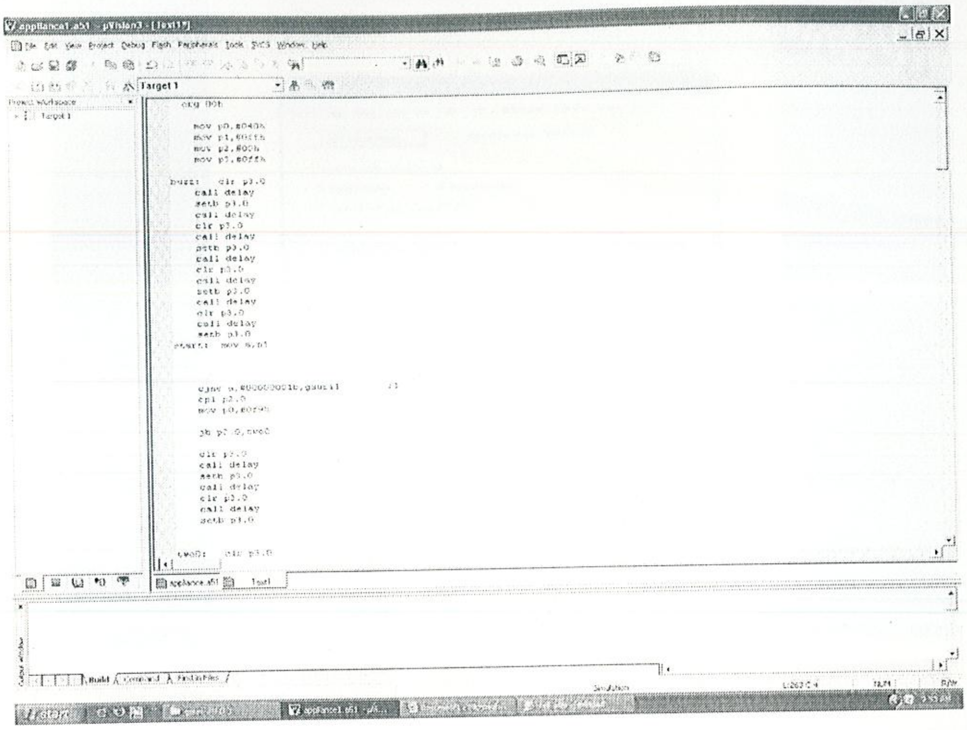
- Go to Project->New Project & Save it with the filename you want.



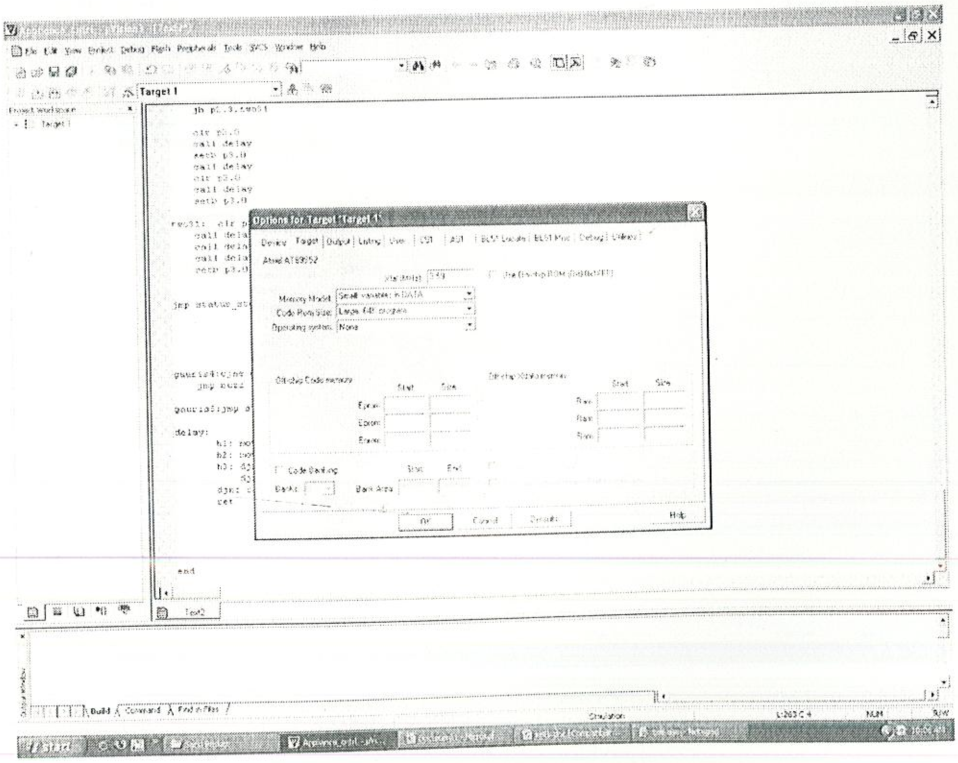
- Select the Microprocessor being used in the project

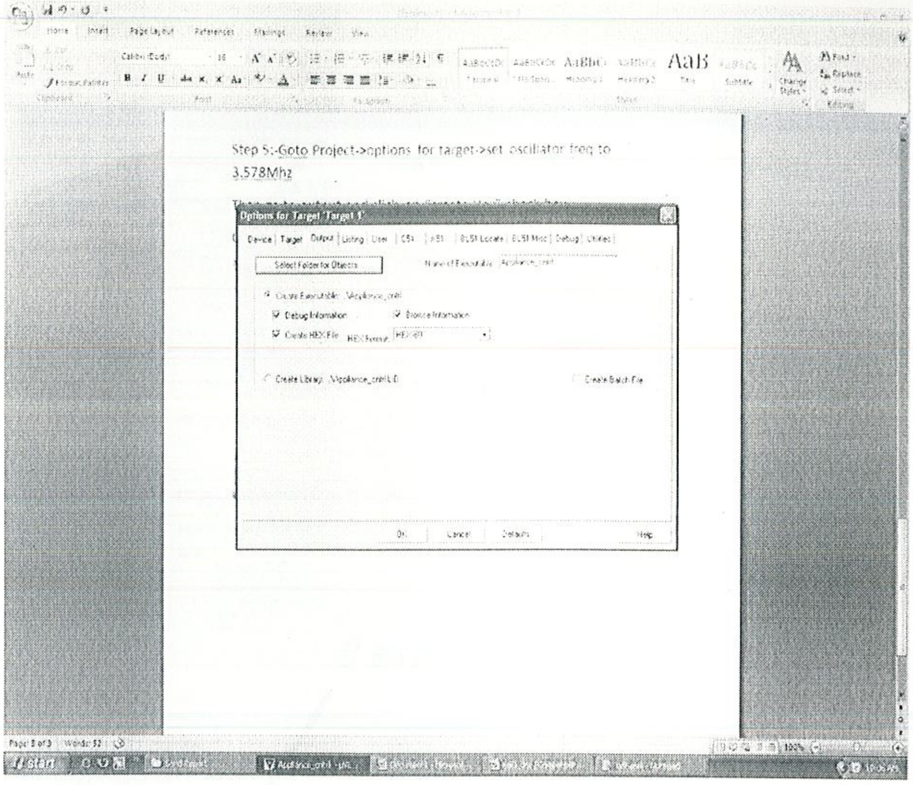


- Go to New & copy the code in it.

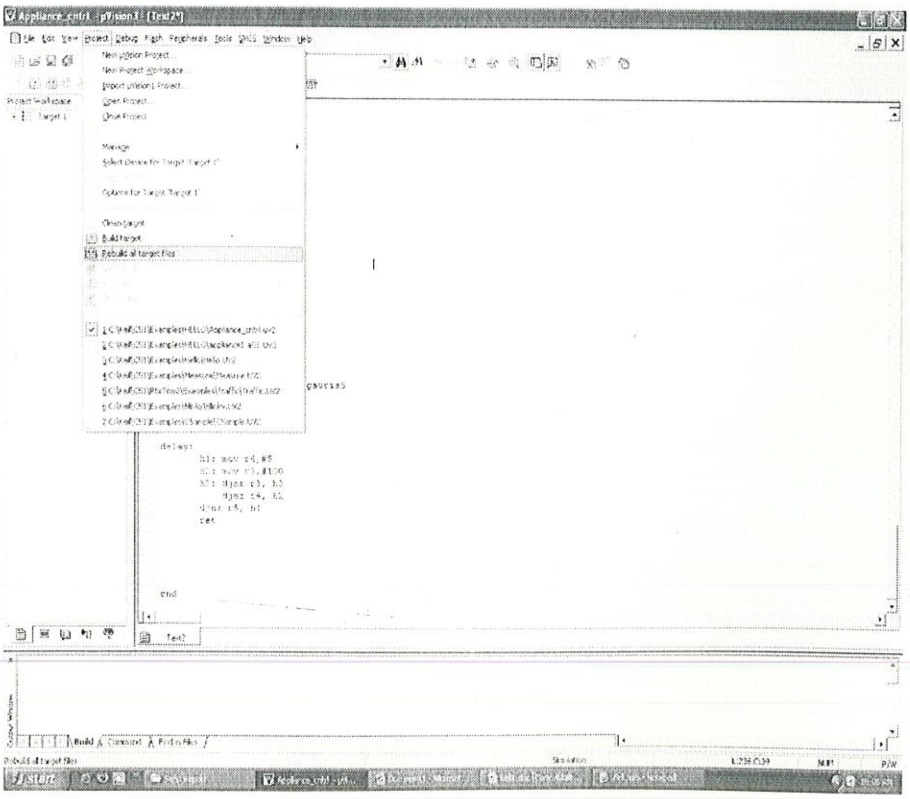


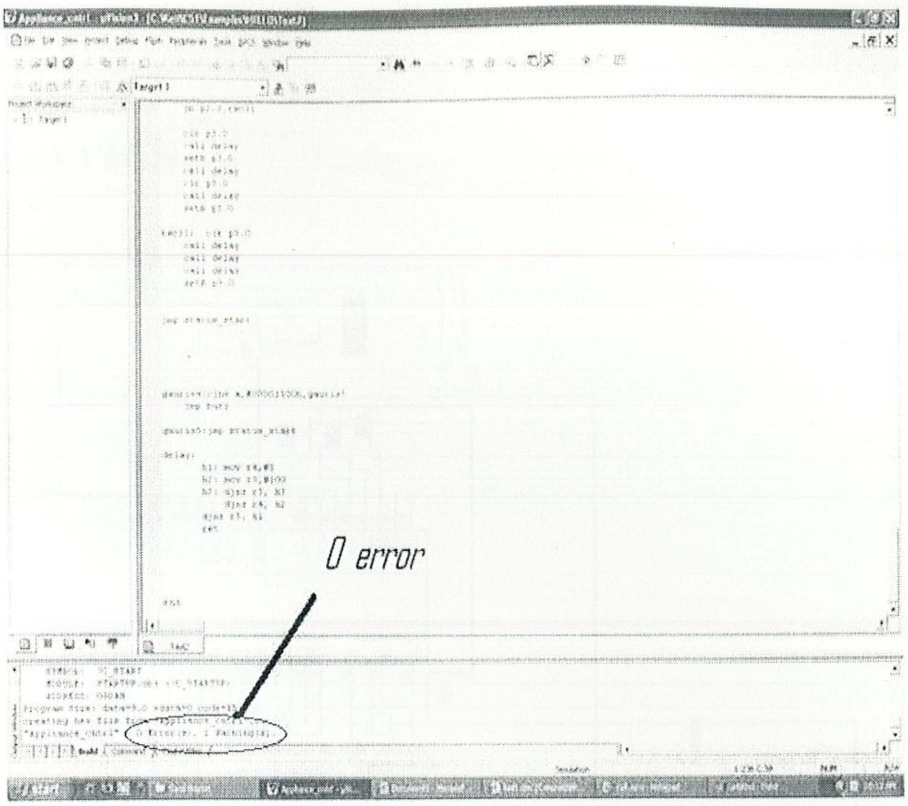
- Go to Project->Options for Target->set Oscillation Frequency to 3.578 MHz Then go to output and click on "Create Hex" check box & click Ok






- Go to Project->Rebuild all Target Files




0 error

Chapter 5

# SCHEMATICS

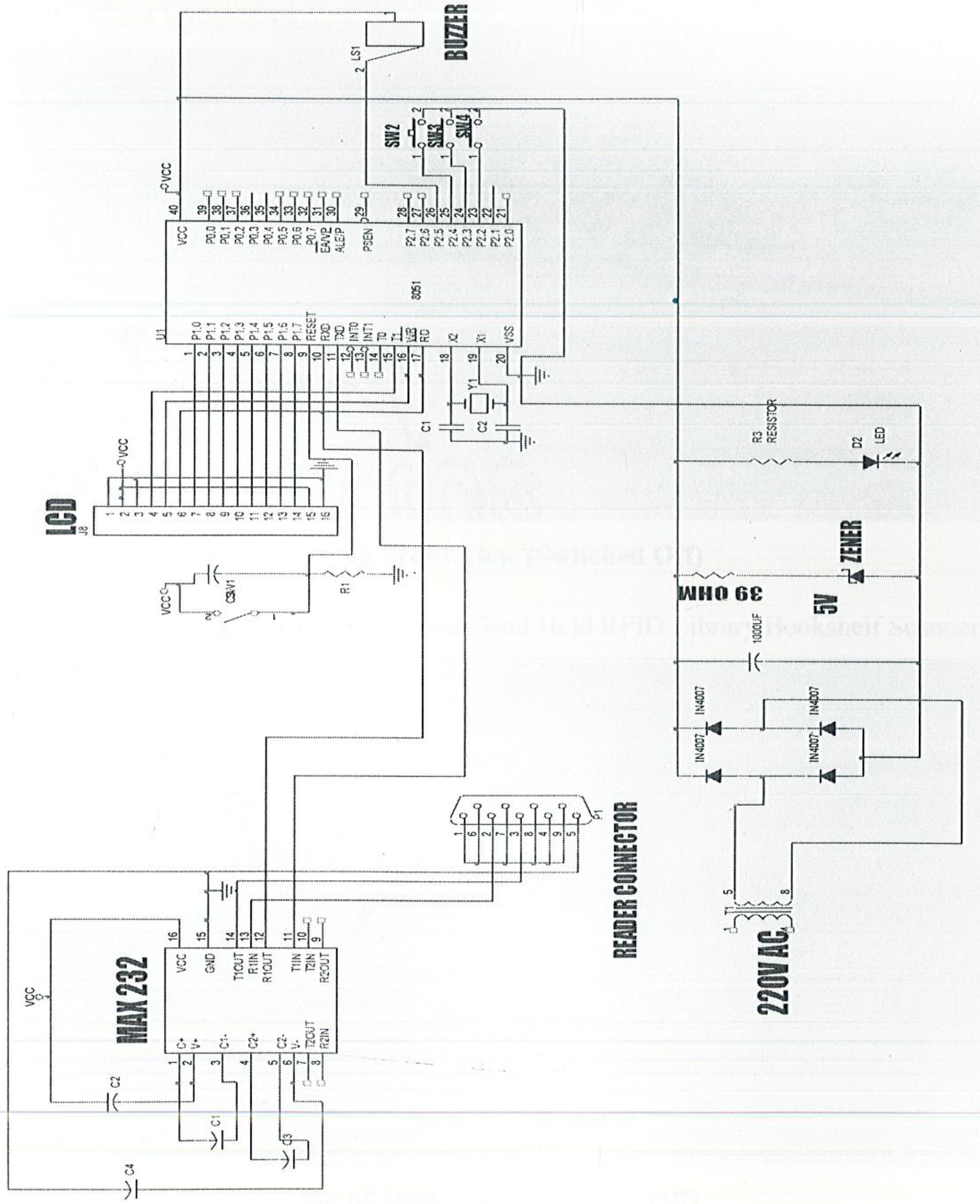



Fig 5 Complete Circuit Diagram

## Chapter 6

# PROJECT SNAPSHOTS

- Front layout of our self designed Hand Held RFID Library Bookshelf Scanner.

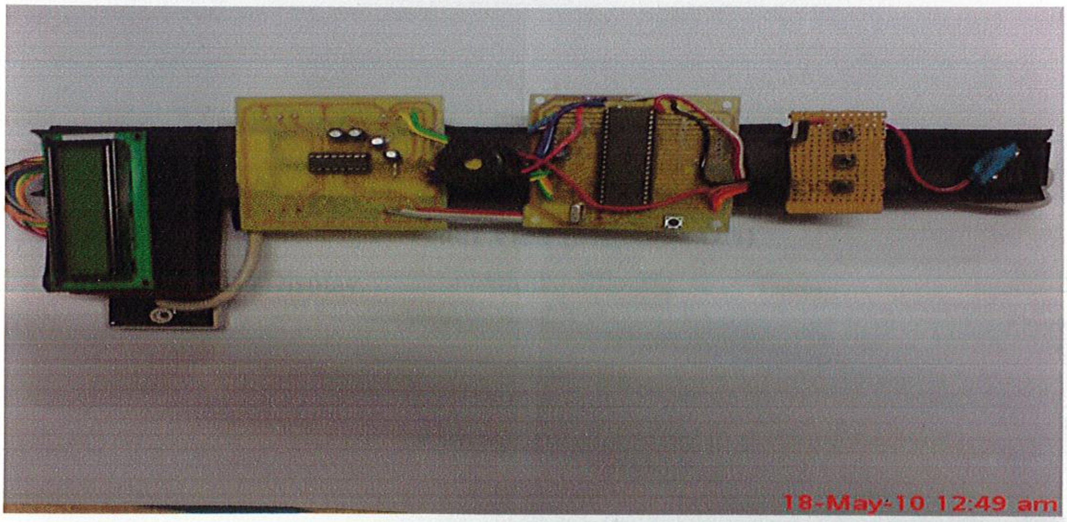



**Fig 6a Front View (Switched Off)**

- Back layout of our self designed Hand Held RFID Library Bookshelf Scanner.

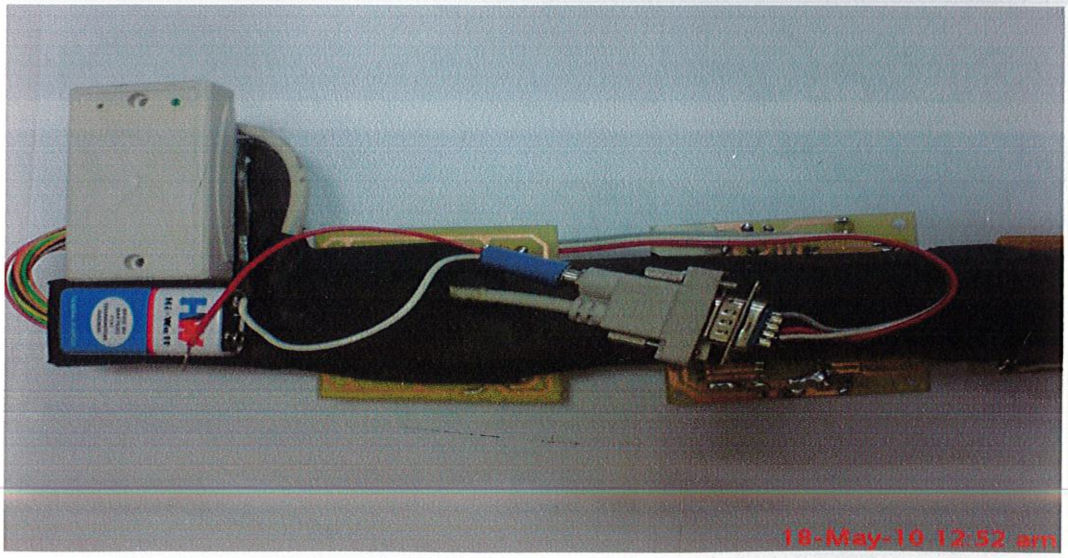



**Fig 6b Back View (Switched Off)**

- Front layout of our self designed Hand Held RFID Library Bookshelf Scanner.

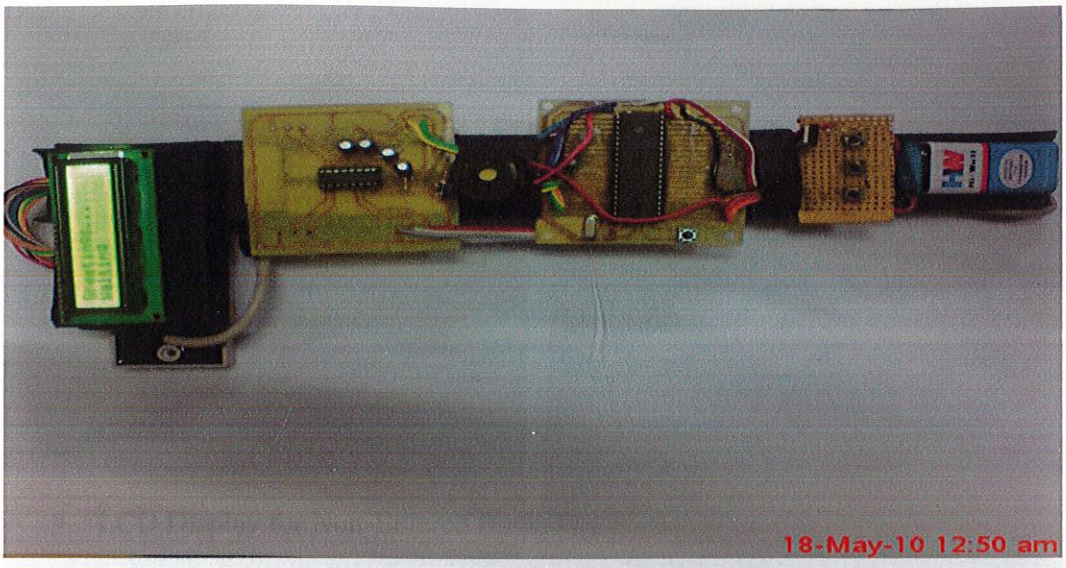



**Fig 6c Front View (Switched ON)**

- Startup LCD Display.

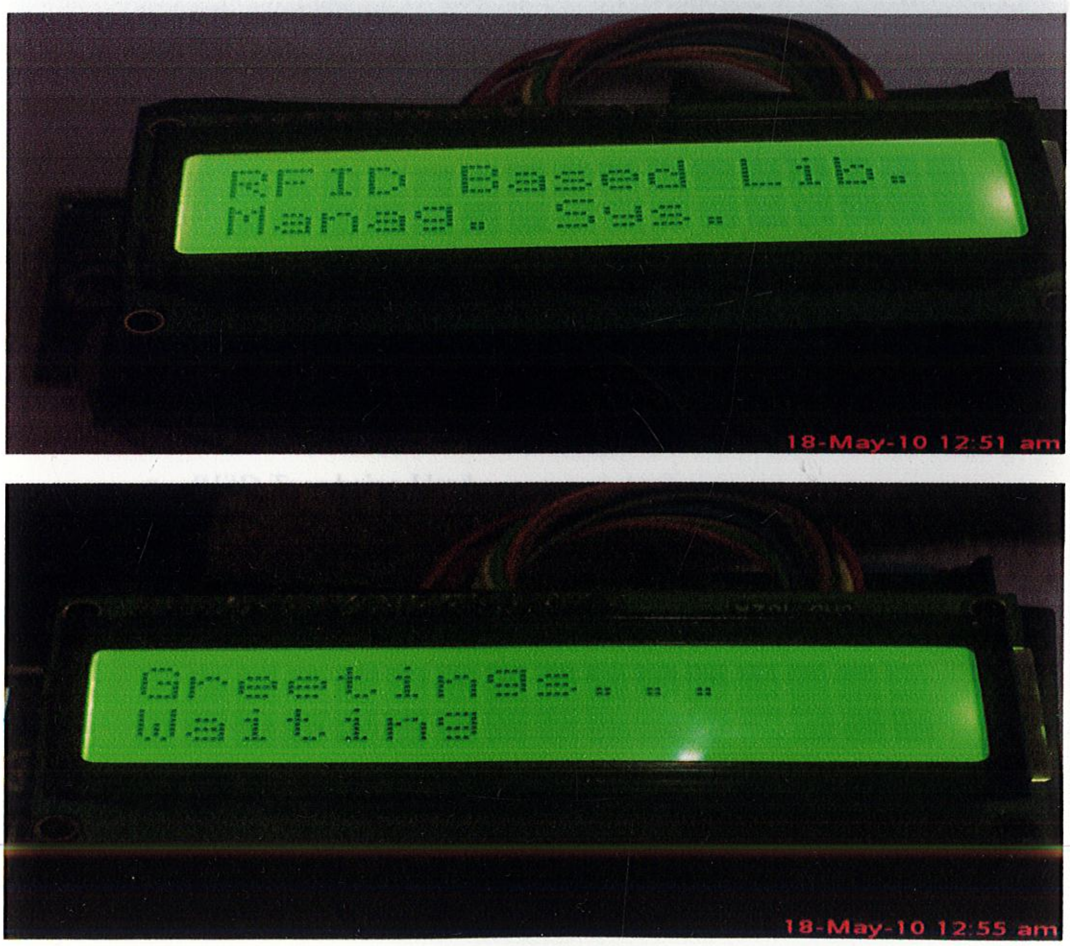
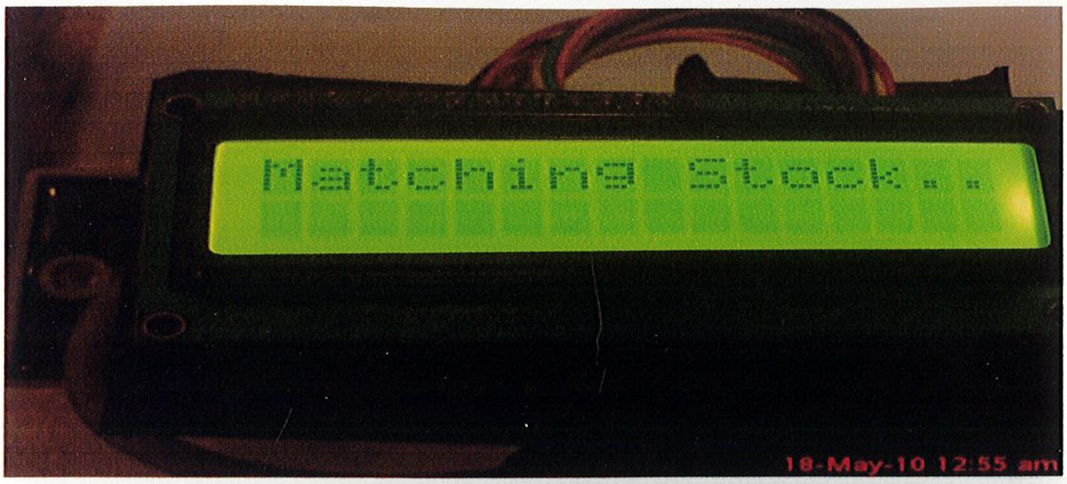



**Fig 6d Start-up LCD Screen**

- LCD Display while Reading Tag.




- LCD Display for Non-Entered Book/Tag

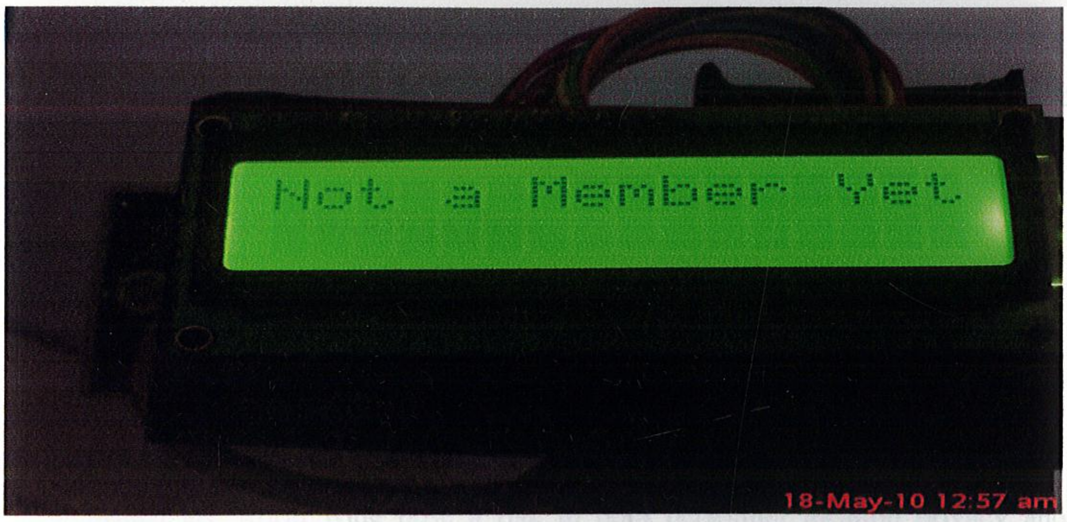



**Fig 6e LCD Display during Operation**

- RFID Tags being Used

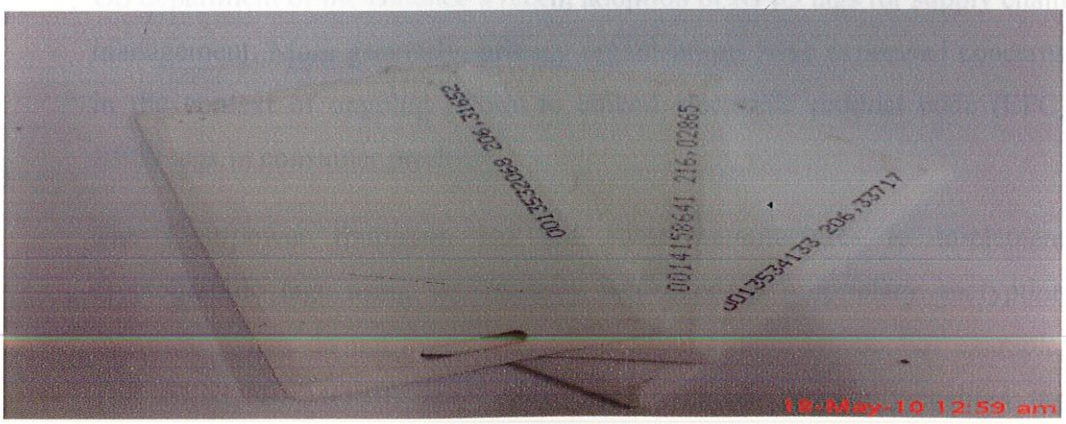



**Fig 6f RFID Tags**

## Chapter 7

# CONTROVERSIES & FUTURE WORK

## 7.1 PROBLEMS & CONCERNS

The main difficulty working with the RFID tags can be summarized as:

- **CARD THEFT**

  The main concern of the thesis is to built a secure RFID based Library Book Shelf management System but if the card is not in the hands of the user then it is illegal.

- **GLOBAL STANDARDIZATION**

  The frequencies used for RFID in the USA are currently incompatible with those of Japan or Europe.

- **SECURITY CONCERNS**

  A primary RFID security concern is the illicit tracking of RFID tags. Tags which are world wide pose a risk to both personnel location privacy and corporate/military security. Such concerns have been raised with respect to the US department of the Defence's recent adoption of RFID tags for supply chain management. More generally, privacy organizations have expressed concerns in the context of ongoing efforts to embed electronic product code (EPC) RFID tags in consumer products.

  The Cost/power limitation has led some manufactures to implement cryptographic tags using substantially weakened or proprietary encryption schemes, which do not necessarily resist sophisticated attack. For example, The EXXON –MOBIL speed pass uses a cryptographically-enabled tag manufactured by TEXAS INSTRUMENTS called the Digital Signature Transponder (DST), which incorporates a weak, proprietary encryption scheme to perform a challenge-response protocol for lower cost. Still other cryptographic protocols attempt to achieve privacy against unauthorized readers, though these protocols are largely in research stage.

- **EXPLOITS**

Ars Technica reported in March 2006 an RFID buffer overflow bug that could infect airport terminal RFID Databases for baggage and also passport databases to obtain confidential information on the passport holder.

- **SHIELDING**

A number of products are available on the market that will allow a concerned carrier of RFID enabled cards or passports to shield their data. In fact the United States government requires their new employee ID cards to be delivered with an approved shielding sleeve or holder. There are contradicting opinions as to whether Al can prevent reading of RFID chips. Some people claim that Al shielding, essentially creating a Faraday cage, does work. Others claim that simply wrapping an RFID card in Al foil, only makes transmission more difficult, yet is not completely effective at preventing it.

## 7.2 FUTURE SCOPE

This project can be developed further with following suggestions:

- RFID Book Bind Tags being used instead of conventional tags.
- Mountable Antennas being installed in Shelf for auto indication while wrong shelving.
- Mountable Antennas placed in library to narrow down on book location.
- Linking to a Central Database over Wi-Fi.

# REFERENCES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