SMART SHOPPING TROLLEY USING RFID AND ZIGBEE

Submitted in partial fulfillment of the requirements for Bachelor of Engineering degree in
Electronics and telecommunication

By

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Project Report Approval for B. E.

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Of Electronics & Telecommunication Engineering has been accepted in partial fulfillment of the requirement for the bachelor's degree of Electronics & Telecommunication Engineering. This project has been approved.

Examiners:
1.-----------------------------

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Supervisors:
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Chairman:

Date:
Place:

Declaration

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Name of the Student:--------------------------------

Signature of the Student:----------------------------

Date:

Place:

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Chapter 1

Introduction

1.1 Introduction

A shopping trolley is supplied by a shop, especially supermarkets, for use by the customers inside the shop for transport of merchandise between the isles of a supermarket to the check-out counter during the period of shopping.

Generally customers collect the merchandise they need in the trolley and reach up to billing counter for bills. At the counter usually there is long queue in which the customer wasts a lot of precious time At that moment they realize that the merchandise they purchased is over budget. So they reduce the merchandise until the cost is in their budget.

To avoid this problem we are designing the RFID based shopping trolley. Using this project you will get the amount of merchandise before proceeding to the billing counter. So you can add or remove your merchandise before going to billing counter.

1.2 BLOCK DIAGRAM (Cart)

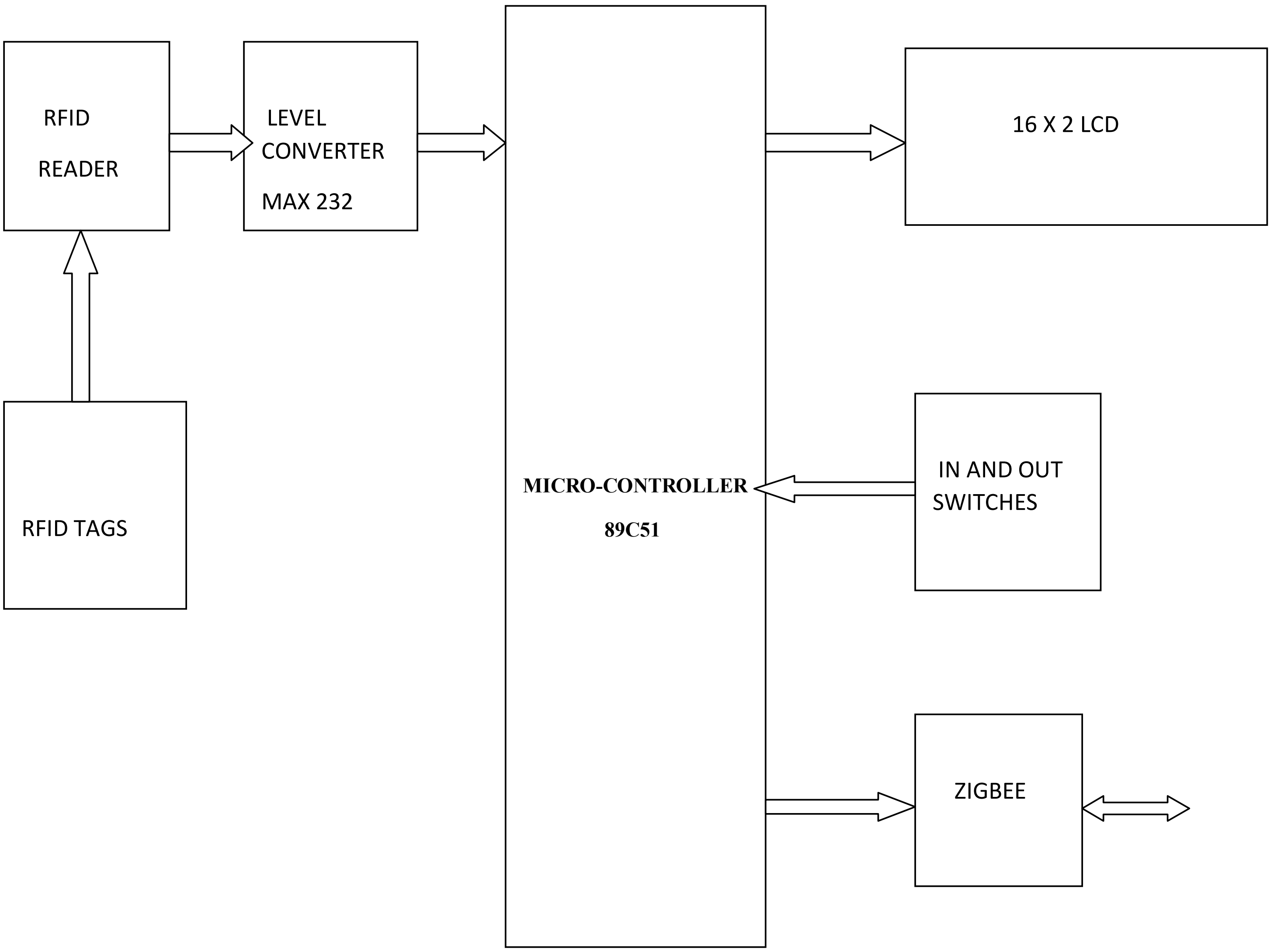


fig-1. Cart

1.2.1 BLOCK DIAGRAM (SERVER/SELLER)

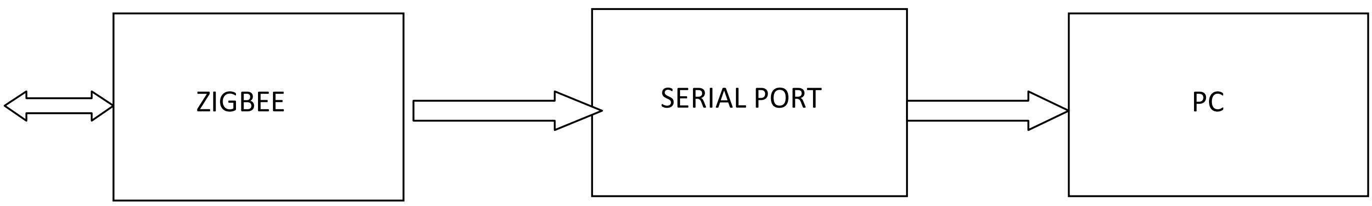
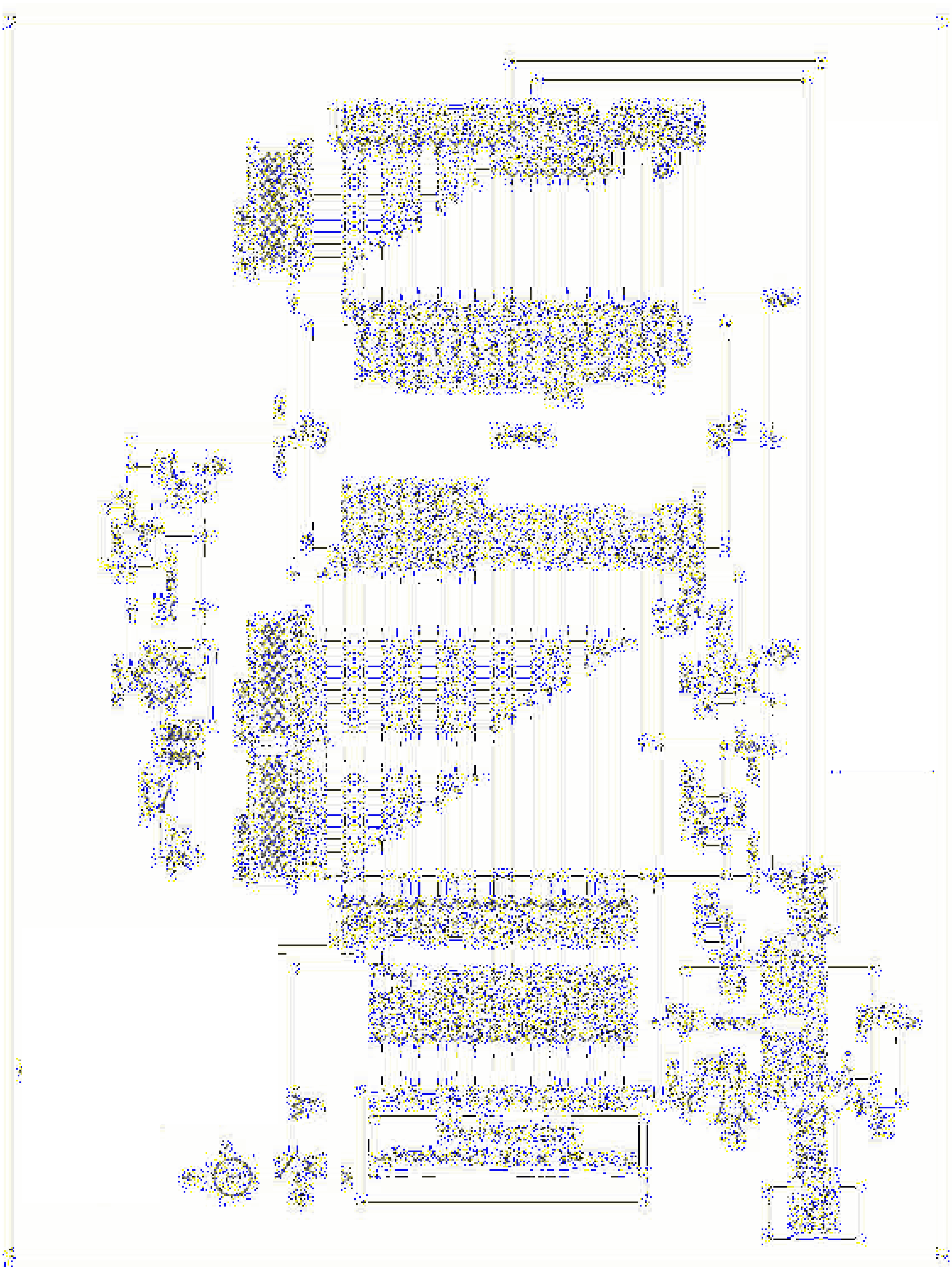


Fig 2.Seller side

1.3 CIRCUIT DIAGRAM



1.4 WORKING OF THE PROJECT

WORKING

When a customer with the cart enters a shopping aisle, the cart is brought in range of the IR Receiver and the microcontroller checks for the aisle information code. The aisle information code is transmitted over the ZigBee wireless from the cart to the server. Based on the aisle number received the database is queried and relevant information is retrieved and transmitted to the cart via the ZigBee module. The received information is stored in the EEPROM present on the cart. This serves as a temporary database until the customer exits the particular aisle that he/she is in. The relevant products information is displayed on the display unit. Every product has an RFID tag which contains a Unique ID. These ID's are fed in the database assigned to the corresponding products. If there needs to be a purchase done, then that product can be dropped in the cart where the RFID reader reads the tag. The information of the product is extracted and displayed on the LCD screen. At the same time billing information is also updated. Upon exit of the aisle, the aisle info is sent to the server along with details of purchase. Server then stores them in the database. These steps are repeated until the end of shopping button is pressed. Once the "Complete" button is pressed there is an option provided to end the shopping with the same products or to delete some of the products from the cart. This goes by the customer choice. At the end of shopping, the customer can straight away pay the bill and leave.

PROBLEM FORMULATION:

Once the consumer gets his desired product from the shelf in the retail store and puts it into the cart, the RFID reader reads the tag on the product and the product information is displayed on the LCD screen. Side by side, the billing information is also upda ted. The working of the smart shopping cart can be explained in the following steps:

1) When shoppers with the cart press "start button" the system turns ON and then all the components such as RFID reader, microcontroller and ZigBee start working.

2) Every product has an RFID tag which contains a unique id. They are fed in the database assigned to the corresponding products.

3) When the shopper puts any product in the cart then the tag is read by the RFID reader. The information of the product is extracted and displayed on the LCD screen. Also side by side, the billing information is also updated.

4) These steps are repeated until the end of shopping button is pressed. Once the "End Shopping" button is pressed the total bill is send to master pc via Wi-Fi (ZigBee).

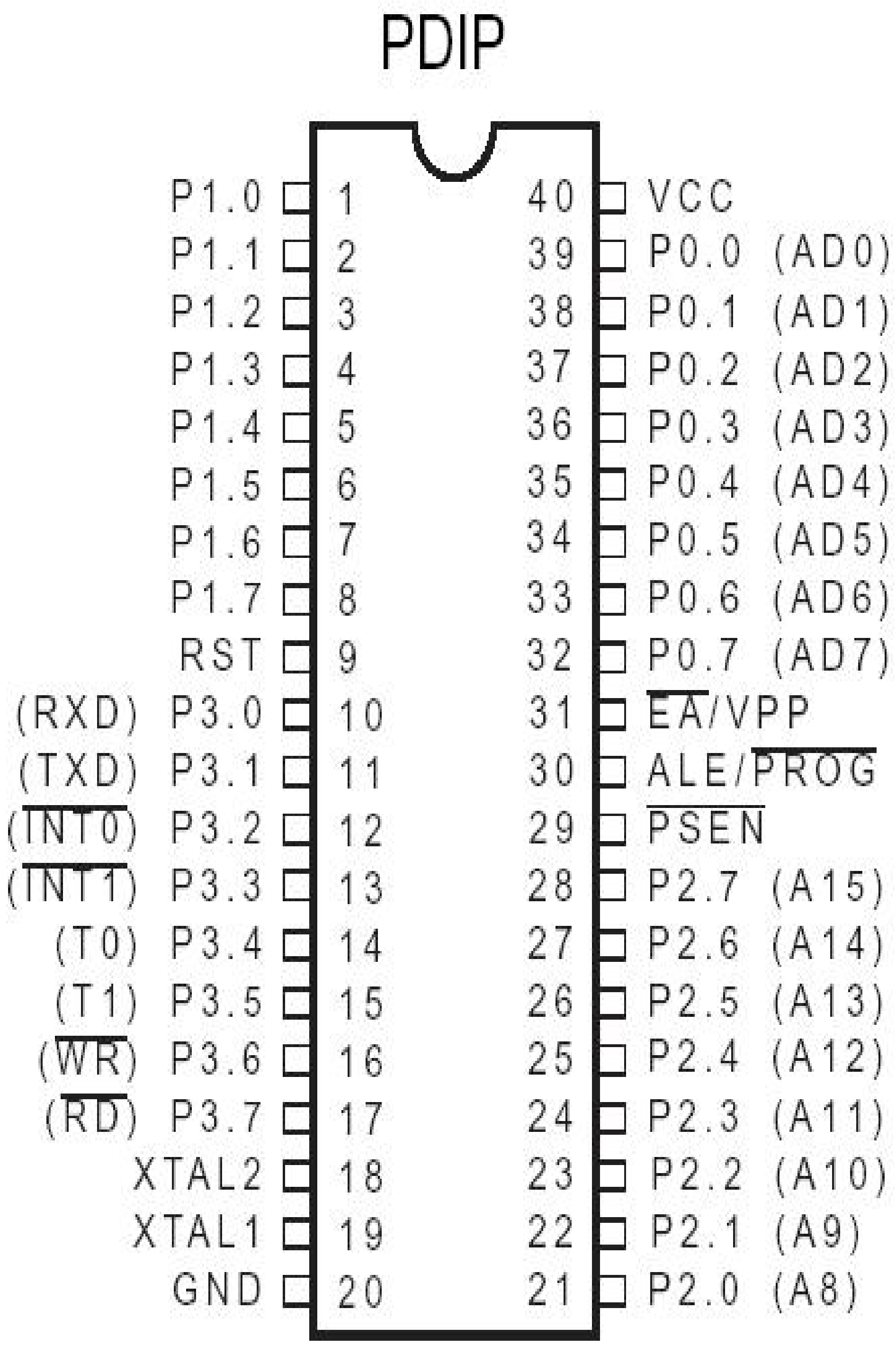
5) There is also an option provided to delete some of the products from the cart and the bill will be updated accordingly, this goes by the customer choice.

6) At the end of shopping, the customer can straight away pay the bill and leave.

Chapter 2

Micro-controller

2.1 Pin diagram



2.2 Description

Pin Description

VCC

Supply voltage.

GND

Ground.

Port 0

Port 0 is an 8-bit open drain bidirectional I/O port. As an output port each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high-impedance inputs. Port 0 may also be configured to be the multiplexed loworder address/data bus during accesses to external program and data memory. In this mode P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pull-ups are required during program verification.

Port 1

Port 1 is an 8-bit bidirectional I/O port with internal pullups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will sourcecurrent (IIL) because of the internal pull-ups.Port 1 also receives the low-order address bytes during Flash programming and program verification.

Port 2

Port 2 is an 8-bit bidirectional I/O port with internal pullups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins they are pulled high by the internal pullups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pullups. Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that use 16-bit addresses (MOVX @ DPTR). In this application it uses strong internal pull-ups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register. Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

Port 3

Port 3 is an 8-bit bidirectional I/O port with internal pullups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 also serves the functions of various special features of the AT89C51 as listed below:

Port Pin	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	$\overline{\text{INT0}}$ (external interrupt 0)
P3.3	$\overline{\text{INT1}}$ (external interrupt 1)
P3.4	T0 (timer 0 external input)
P3.5	T1 (timer 1 external input)
P3.6	$\overline{\text{WR}}$ (external data memory write strobe)
P3.7	$\overline{\text{RD}}$ (external data memory read strobe)

RST

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device.

ALE/PROG

Address Latch Enable output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming. In normal operation ALE is emitted at a constant rate of 1/6 the oscillator frequency, and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external Data Memory. If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode.

PSEN

Program Store Enable is the read strobe to external program memory. When the AT89C51 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

EA/VPP

External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable.Voltage (VPP) during Flash programming, for parts that require 12-volt VPP.

XTAL1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2

Output from the inverting oscillator amplifier.

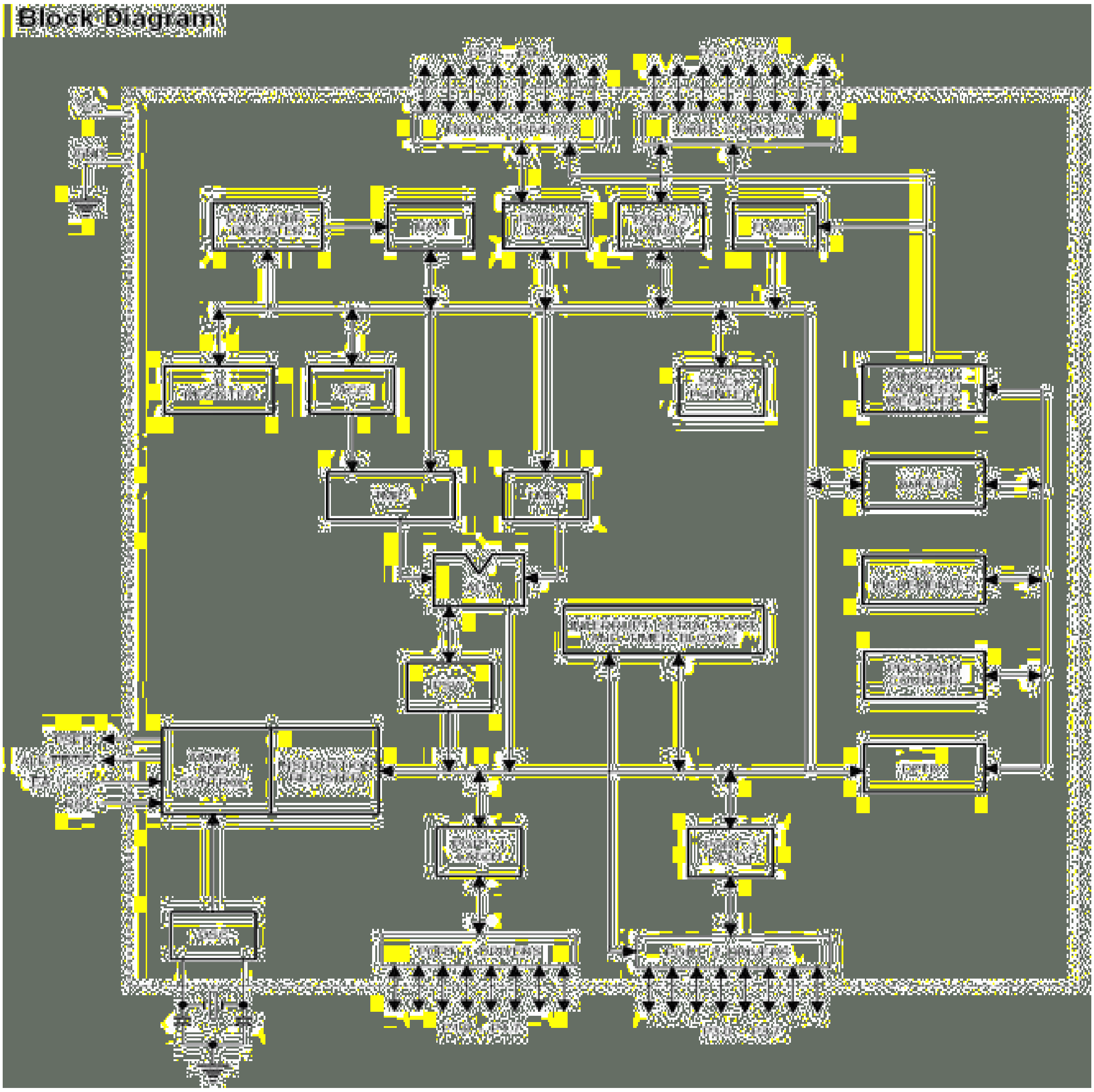


Fig 5 Block diagram of Microcontroller.

Chapter 3

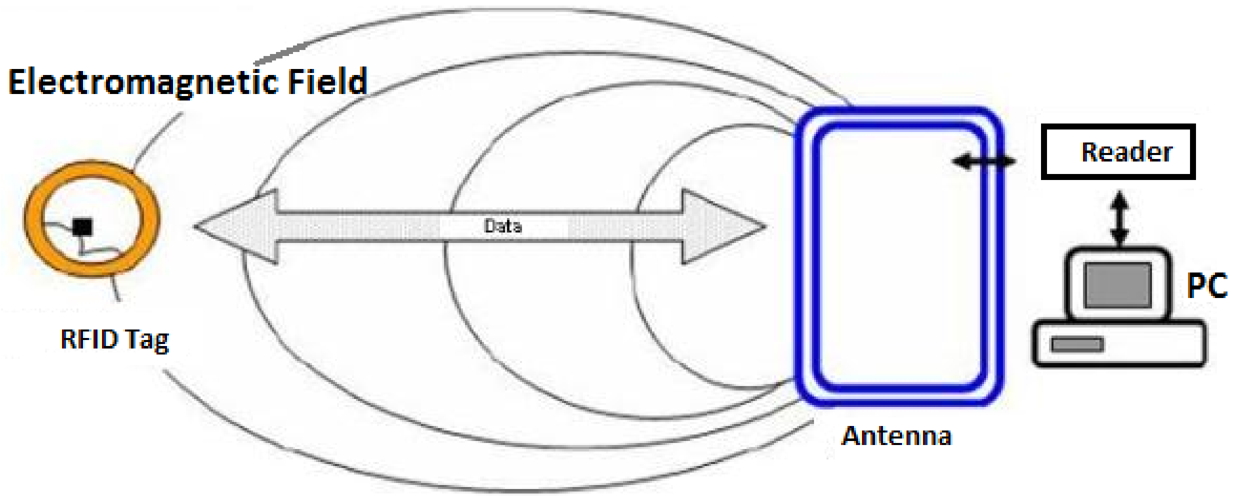
RFID

3.1 Description & Working

RFID (radio frequency identification) is a technique facilitating identification of any product or item without the requirement of any line of sight amid transponder and reader.

RFID Structure is continuously composed of 2 main hardware components. The transponder which is located on the product to be scanned and the reader which can be either just a reader or a read & write device, depending upon the system design, technology employed and the requirement. The RFID reader characteristically comprise of a radio frequency module, a controlling unit for configurations, a monitor and an antenna ti investigate the RFID tags. In addition, a number of RFID readers are in-built with an extra interface allowing them to forward the data received to another system (control system or PC).

RFID Tag – The actual data carrying tool of an RFID structure, in general comprise of an antenna (coupling element) and an electronic micro-chip.



Passive RFID Tags:

Passive tags comprise of 3 key components, namely, an in-built chip, a substrate and an antenna. The in-built chip is also known as a circuit and is utilized to perform some precise tasks along with accumulating data. Passive RFID tags can comprise of various kinds of micro-chips depending on the structural design of a particular tag. These chips can be MO (read only) or WORM (write once chip other than read many) or RW (read write) chip. A general RFID chip is competent of accumulating 96 bits of data but some other chips have a capacity of storing 1000-2000 bits.Passive tag has an antenna which is attached to the micro-chip. This antenna is employed for transferring data using radio waves. The passive tag's performance is reliant on the size of the antenna. In the performance of tags the shape of the antenna also plays a significant role. The third part of the tag is substrate , the substrate is a plastic coating or Mylar which is employed to unite the antenna & the chip. Passive RFID tags are smaller in size as well as cheap on pockets too.

Active RFID Tags:

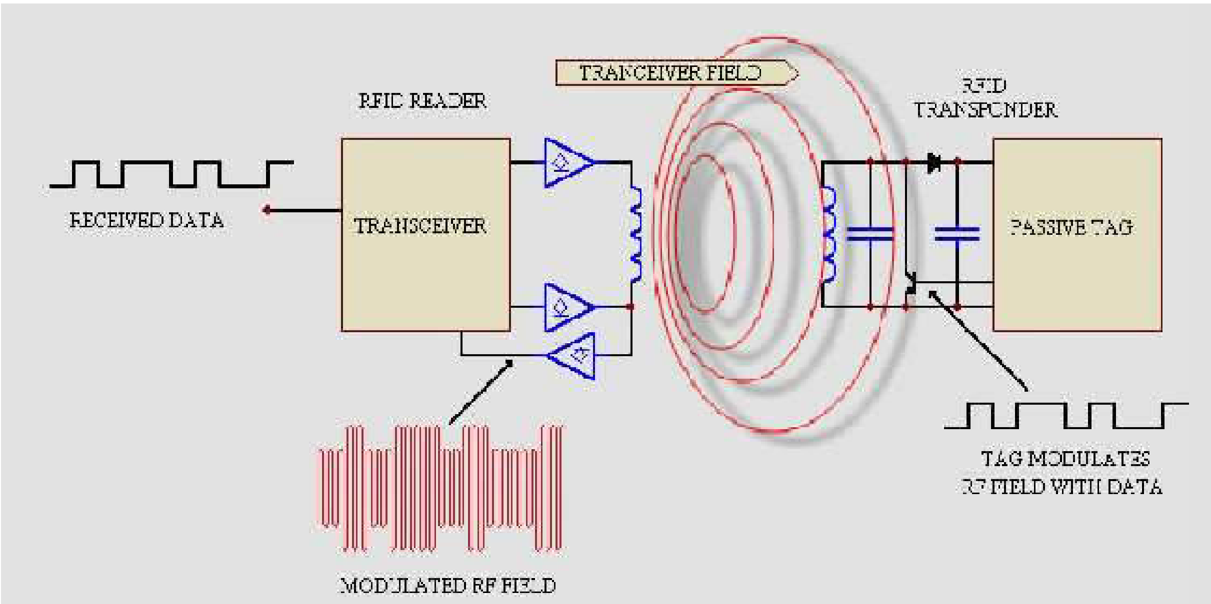
Active tags comprise of same components that exists in passive tags. They too comprise of a micro-chip and an antenna but the only comparison between the two is that the size of the micro-chip in active tags is larger than passive tags' chip. An active tag is incorporated with a built-in power supply. Maximum of the active tags make use of batteries whereas some of them work on solar cells. The inbuilt power system facilitates the tag to be used as an independent reader which is competent of transferring information devoid of outer assistance. Active RFID tags are available with some extra features such as microprocessors, serial ports & sensors. The highly

developed technology in existing in active RFID tag formulates it more capable in comparison to passive tags as the active tags can be easily employed for a large array of tasks. RFID Micro-Chip tags are basically fabricated to function at certain frequencies which are license free.

These are:

- High Frequency (HF) 13.56 MHz
- Microwave 2.45 GHz
- Ultra High Frequency (UHF) 868-930 MHz
- Low Frequency (LF) 125-135 KHz
- Microwave 5.8 GHz.

Working of RFID



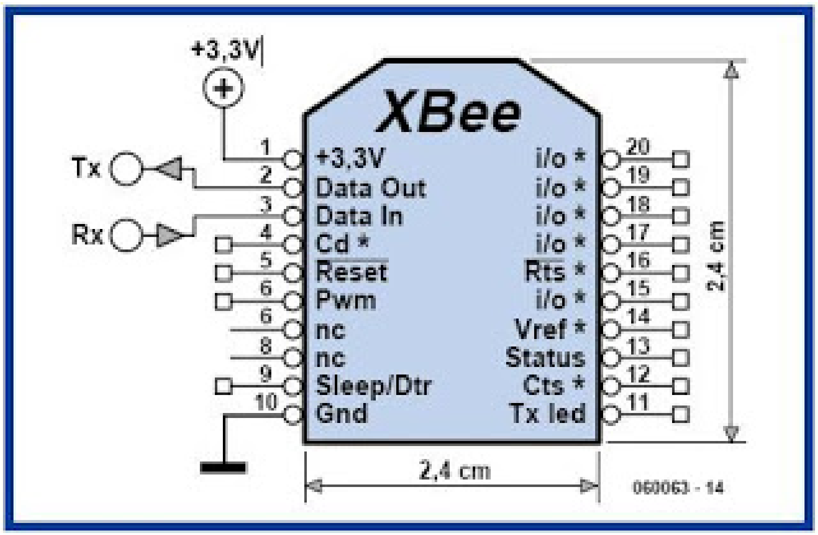
- Every RFID system the transponder Tags contain information.
- Information can be as little as a single binary bit, or large array of bits like an identity code, personal medical information, or literally any type of information that can be stored in digital binary format.
- Reader generates RF carrier sine waves.
- Once tag receives sufficient energy, Tags output transistor shunts the coil corresponding to the data being clocked out of memory array.
- Reader performed digital data encoding.

Chapter 4

Zigbee

4.1 Description

PIN Configuration



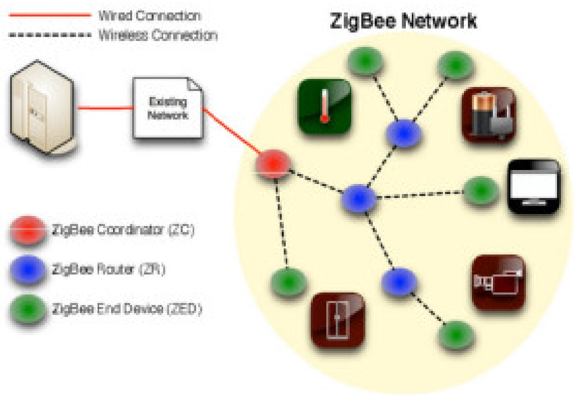
ZIGBEE Technology:

Zigbee communication is specially built for control and sensor networks on IEEE 802.15.4 standard for wireless personal area networks (WPANs), and it is the product from Zigbee alliance. This communication standard defines physical and Media Access Control (MAC) layers to handle many devices at low-data rates. These Zigbee's WPANs operate at 868 MHz, 902-928MHz and 2.4 GHz frequencies. The date rate of 250 kbps is best suited for periodic as well as intermediate two way transmission of data between sensors and controllers.

Zigbee is low-cost and low-powered mesh network widely deployed for controlling and monitoring applications where it covers 10-100 meters within the range. This communication system is less expensive and simpler than the other proprietary short-range wireless networs sensors as bluetooth and Wi-Fi.

Zigbee supports different network configurations for master to master or master to slave communications. And also, it can be operated in different modes as a result the battery power is conserved. Zigbee networks are extendable with the use of routers and allow many nodes to interconnect with each other for building a wider area network.

ZIGBEE Architecture



Zigbee system structure consists of three different types of devices such as Zigbee coordinator, Router and End device. Every Zigbee network must consist of at least one coordinator which acts as a root and bridge of the network. The coordinator is responsible for handling and storing the information while performing receiving and transmitting data operations. Zigbee routers act as intermediary devices that permit data to pass to and fro through them to other devices. End devices have limited functionality to communicate with the parent nodes such that the battery power is saved as shown in the figure. The number of routers, coordinators and end devices depends on the type of network such as star, tree and mesh networks.

Zigbee protocol architecture consists of a stack of various layers where IEEE 802.15.4 is defined by physical and MAC layers while this protocol is completed by accumulating Zigbee's own network and application layers.

Physical Layer: This layer does modulation and demodulation operations up on transmitting and receiving signals respectively.

MAC Layer: This layer is responsible for reliable transmission of data by accessing different networks with the carrier sense multiple access collision avoidance (CSMA). This also transmits the beacon frames for synchronizing communication.

Network Layer: This layer takes care of all network related operations such as network setup, end device connection and disconnection to network, routing, device configurations, etc.

Application Support Sub-Layer: This layer enables the services necessary for Zigbee device object and application objects to interface with the network layers for data managing services. This layer is responsible for matching two devices according to their services and needs.

Application Framework: It provides two types of data services as key value pair and generic message services. Generic message is a developer defined structure, whereas the key value pair is used for getting attributes within the application objects. ZDO provides an interface between application objects and APS layer in Zigbee devices. It is responsible for detecting, initiating and binding other devices to the network.

4.2 Zigbee Operating Modes and Its Topologies

Zigbee two way data is transferred in two modes: Non-beacon mode and Beacon mode. In a beacon mode, the coordinators and routers continuously monitor active state of incoming data hence more power is consumed. In this mode, the routers and coordinators do not sleep because at any time any node can wake up and communicate. However, it requires more power supply and its overall power consumption is low because most of the devices are in an inactive state for over long periods in the network.

In a beacon mode, when there is no data communication from end devices, then the routers and coordinators enter into sleep state. Periodically this coordinator wakes up and transmits the beacons to the routers in the network. These beacon networks are work for time slots which means, they operate when the communication needed results in lower duty cycles and longer battery usage. These beacon and non-beacon modes of Zigbee can manage periodic (sensors data), intermittent (Light switches) and repetitive data types.

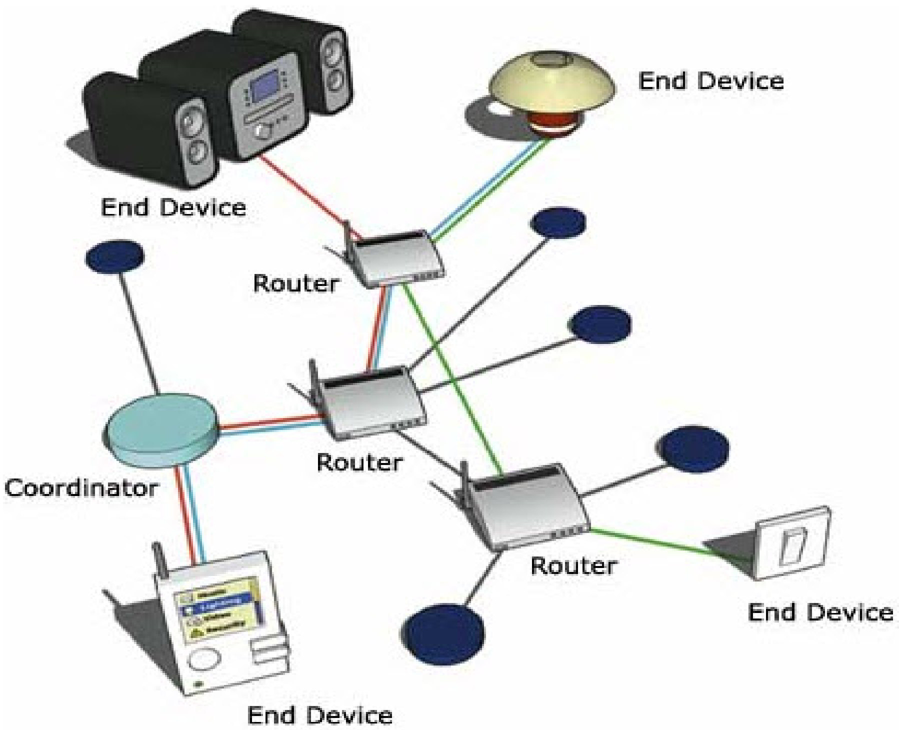
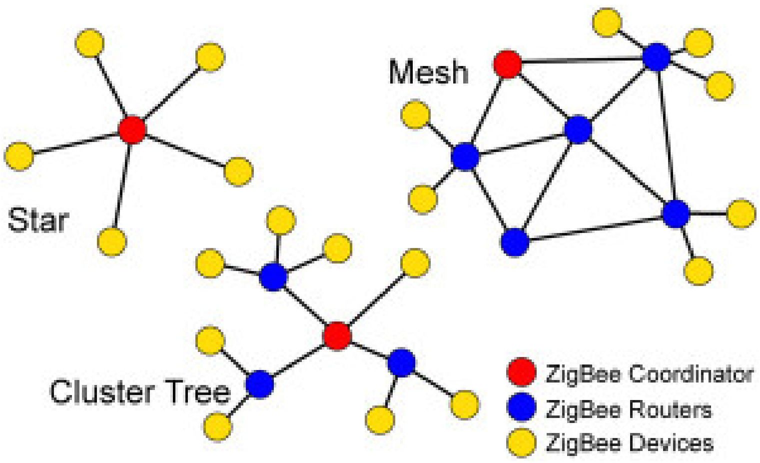


fig-Zigbee operating modes

Zigbee Topologies



Zigbee supports several network topologies; however, the most commonly used configurations are star, mesh and cluster tree topologies. Any topology consists of one or more coordinator. In a star topology, the network consists of one coordinator which is responsible for initiating and managing the devices over the network. All other devices are called end devices that directly communicate with coordinator. This is used in industries where all the end point devices are needed to communicate with central controller , and this topology is simple and easy to deploy.

In mesh and tree topologies, the Zigbee network is extended with several routers where coordinator is responsible for staring them. These structures allow any device to communicate with any other adjacent node for providing redundancy to the data. If any node fails, the information is routed automatically to other device by these topologies. As the redundancy is the main factor in industries, hence mesh topology is mostly used. In a cluster-tree network, each cluster consists of a coordinator with leaf nodes, and these coordinators are connected to parent coordinator which initiates the entire network.

Due to the advantages of Zigbee technology like low cost and low power operating modes and its topologies, this short range communication technology is best suited for several applications compared to other proprietary communications, such as Bluetooth, Wi-Fi, etc.

Chapter 5

Other System Hardwares

5.1 MAX 232 IC (DUAL DRIVER/RECEIVER)

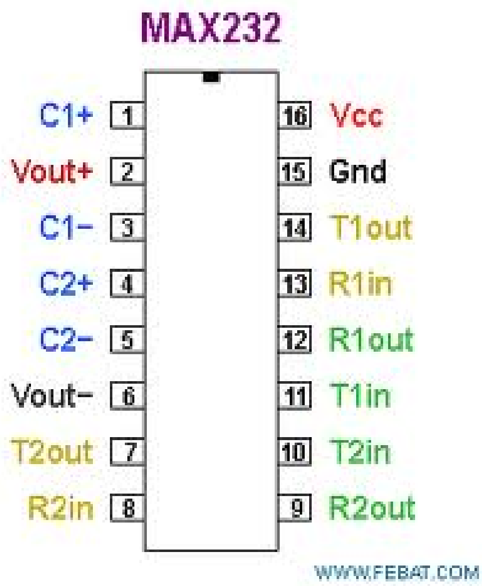


Fig- Pin diagram of MAX 232 IC

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels.

These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels. The driver, receiver, and voltage-generator functions are available as cells in the Texas Instruments LinASIC library.The MAX232 from Maxim was the first IC which in one package contains the necessary drivers (two) and receivers (also two), to adapt the RS-232 signal voltage levels to TTL logic. It became popular, because it just needs one voltage (+5V) and generates the necessary RS-232 voltage levels (approx. -10V and +10V) internally. This greatly simplified the design of circuitry. Circuitry designers no longer need to design and build a power supply with three voltages (e.g. -12V, +5V, and +12V), but could just provide one +5V power supply, e.g. with the help of a simple 78x05 voltage regulator.

The MAX232 has a successor, the MAX232**A**. The ICs are almost identical, however, the MAX232A is much more often used (and easier to get) than the original MAX232, and the MAX232A only needs external capacitors 1/10th the capacity of what the original MAX232 needs. It should be noted that the MAX232(A) is just a driver/receiver. It does not generate the necessary RS-232 sequence of marks and spaces with the right timing, it does not decode the RS-232 signal, it does not provide a serial/parallel conversion. **All it does is to convert signal voltage levels**. Generating serial data with the right timing and decoding serial data has to be done by additional circuitry, e.g. by a 16550 UART or one of these small micro controllers getting more and more popular.

The MAX232 and MAX232A were once rather expensive ICs, but today they are cheap. It has also helped that many companies now produce clones. These clones sometimes need different external circuitry, e.g. the capacities of the external capacitors vary. It is recommended to check the data sheet of the particular manufacturer of an IC instead of relying on Maxim's original data sheet.

The original manufacturer (and now some clone manufacturers, too) offers a large series of similar ICs, with different numbers of receivers and drivers, voltages, built-in or external capacitors, etc. E.g. The MAX232 and MAX232A need external capacitors for the internal voltage pump, while the MAX233 has these capacitors built-in. The MAX233 is also between three and ten times more expensive in electronic shops than the MAX232A because of its internal capacitors. It is also more difficult to get the MAX233 than the garden variety MAX232A.

A similar IC, the MAX3232 is nowadays available for low-power 3V logic.

Features

1.Inline with all the technical standard RS-232C

2.Only requires a single 5V power supply

3.Chip charge pump with a boost, voltage, polarity reversal ability to generate 10V and-10V voltage V

4. The internal integration of the two RS-232C receivers.

5.+-30 V input levels.

5.2 LCD (LIQUID CRYSTAL DISPLAY)

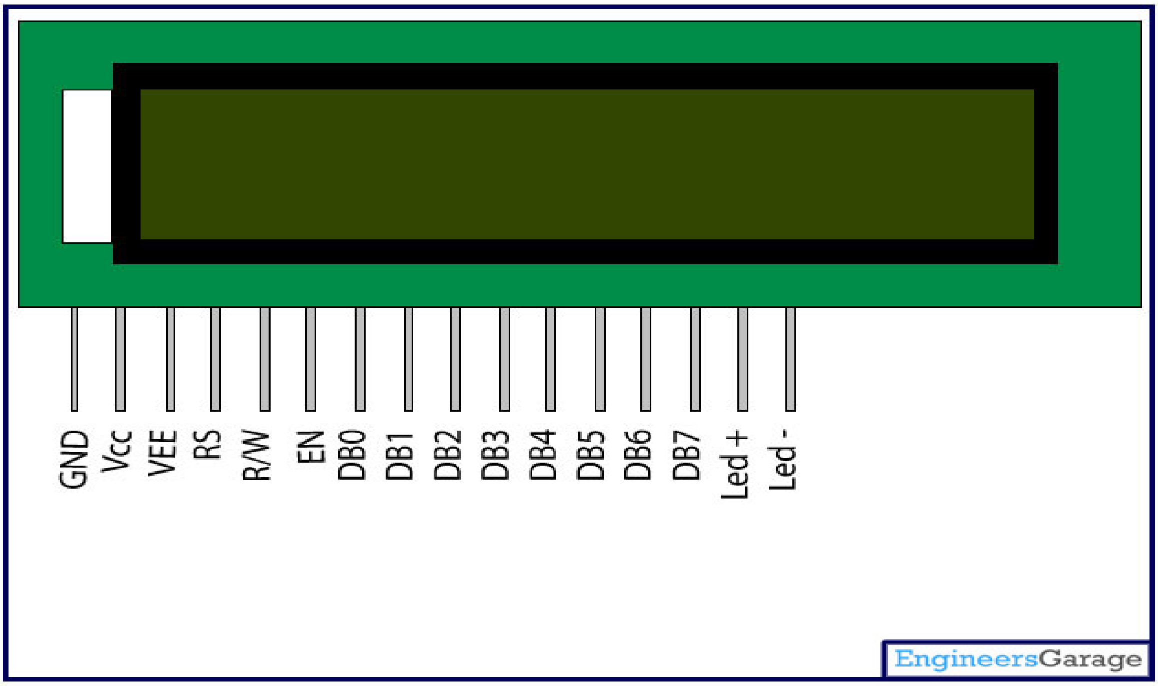


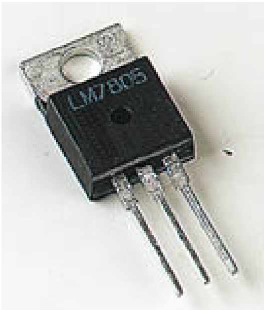
fig- pin diagram of LCD

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

5.3 Three Terminal Voltage Regulator:



A three terminal voltage regulator is a regulator in which the output voltage is set at some predetermined value. Such regulators do not require an external feedback connection. Hence, only three terminals are required for device of such types, input (Vin) output (Vo) and a ground terminal. Since the regulator operates at a preset output voltage the current limiting resistor is also internal to the device. The main advantages of such regulators are the simplicity of connections to the external circuit and the minimum of external components. Fig. Shows the basic circuit configuration of the three terminal voltage regulator. Although, the three terminal regulators offers only fixed output voltages, there are wide variety of voltages available, both +Ve and – Ve. The output current range from 100 m A to 3 A.

LM 78 MXX series 3 terminal positive voltage regulators.

The LX78MXX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. The voltage available allow these regulators to be used in logic system, instrumentation, Hi – Fi and other solid state electronic equipment. Although designed primarily devices can be used with external component to obtain adjustable voltage and current.

Features:

1) Internal thermal overload protection.
2) NO external components required.
3) Output transistor safe area protection.
4) Internal short circuit current limit.
5) Circularity allows start up even if output is pulled to negative voltage (I supplies)

Absolute maximum rating:

Input voltage	35 V
internal power dissipation	Internally limited.
Operating temperature range	0^0 to 70^0 c
Maximum junction temperature	+ 125^0c
Storage temperature range	- 65^0v to 150^0c
Lead temperature	+ 230^0c

5.4 Buzzer and Bleeper

These devices are output transducers converting electrical energy to sound. They contain an internal oscillator to produce the sound, which is set at about 400Hz for buzzers and about 3kHz for bleepers.

Buzzers have a voltage rating but it is only approximate, for example 6V and 12V buzzers can be used with a 9V supply. Their typical current is about 25mA.

Bleepers have wide voltage ranges, such as 3-30V, and they pass a low current of about 10mA.

Buzzers and bleepers must be connected the right way round, their red lead is positive(+).

fig-buzzer.

5.5 Capacitor Diode & LED

5.5.1 Capacitor

Capacitors store electric charge. They are used to smooth varying DC supplies by acting as a reservoir of charge. They are also used in filter circuits because capacitors easily pass AC (changing) signals but they block DC (constant) signals.

Polarised capacitors

Electrolytic capacitors are polarized and they must be connected the correct way round, at least one of their leads will be marked + or -. They are not damaged by heat when soldering.

There are two designs of electrolytic capacitors; axial where the leads are attached to each end (220µF in picture) and radial where both leads are at the same end (10µF in picture). Radial capacitors tend to be a little smaller and they stand upright on the circuit board.

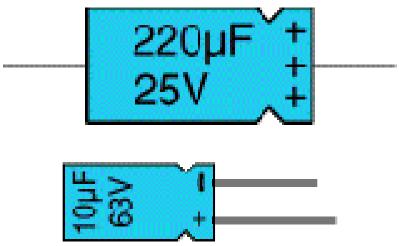


fig-polarised capacitor

Unpolarised capacitors

Small value capacitors are unpolarised and may be connected either way round. They are not damaged by heat when soldering, except for one unusual type (polystyrene). It can be difficult to find the values of these small capacitors because there are many types of them and several different labeling systems.

Many small value capacitors have their value printed but without a multiplier, so you need to use experience to work out what the multiplier should be!

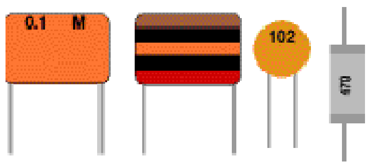


fig-unpolarised capacitor

5.5.2 Diode

Diodes allow electricity to flow in only one direction. The arrow of the circuit symbol shows the direction in which the current can flow. Diodes are the electrical version of a valve and early diodes were actually called valves.

Forward Voltage Drop

Electricity uses up a little energy pushing its way through the diode, rather like a person pushing through a door with a spring. This means that there is a small voltage across a conducting diode, it is called the forward voltage drop and is about 0.7V for all normal diodes which are made from silicon. The forward voltage drop of a diode is almost constant whatever the current passing through the diode so they have a very steep characteristic (current-voltage graph).

Reverse Voltage

When a reverse voltage is applied a perfect diode does not conduct, but all real diodes leak a very tiny current of a few µA or less. This can be ignored in most circuits because it will be very much smaller than the current flowing in the forward direction. However, all diodes have a maximum reverse voltage (usually 50V or more) and if this is exceeded the diode will fail and pass a large current in the reverse direction, this is called breakdown.

Ordinary diodes can be split into two types: Signal diodes which pass small currents of 100mA or less and Rectifier diodes which can pass large currents. In addition there are LED (which have their own page) and Zener diodes (at the bottom of this page).

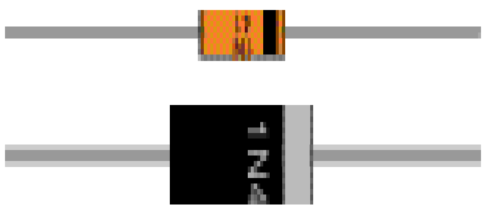
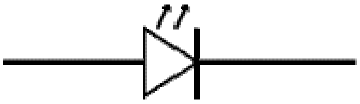
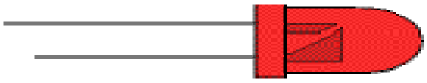


fig-Diode

5.5.3 LED

LEDs emit light when an electric current passes through them.





Colours of LEDs

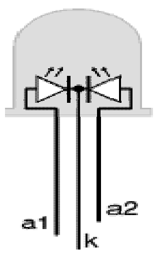
LEDs are available in red, orange, amber, yellow, green, blue and white.

Blue and white LEDs are much more expensive than the other colours.

The colour of an LED is determined by the semiconductor material, not by the colouring of the 'package' (the plastic body). LEDs of all colours are available in uncoloured packages which may be diffused (milky) or clear (often described as 'water clear'). The coloured packages are also available as diffused (the standard type) or transparent.

Bi-colour LEDs

A bi-colour LED has two LEDs wired in 'inverse parallel' (one forwards, one backwards) combined in one package with two leads. Only one of the LEDs can be lit at one time and they are less useful than the tri-colour LEDs



Chapter 6

System Software(Program)

6.1 PROGRAM

```
;	P0.0	=
;	P0.1	=
;	P0.2	=
;	P0.3	=
;	P0.4	=
;	P0.5	=
;	P0.6	=
;	P0.7	=	BUZZER
;
;	P1.0	=	LCD D0
;	P1.1	=	LCD D1
;	P1.2	=	LCD D2
;	P1.3	=	LCD D3
;	P1.4	=	LCD D4
;	P1.5	=	LCD D5
;	P1.6	=	LCD D6
;	P1.7	=	LCD D7
;
;	P2.0	=	IN  / OUT SWUTCH
;	P2.1	=
```

```
;	P2.2	=
;	P2.3	=
;	P2.4	=
;	P2.5	=
;	P2.6	=
;	P2.7	=  START
;
;	P3.0	=	TXD
;	P3.1	=	RXD
;	P3.2	=	LCD RS
;	P3.3	=	LCD R/W
;	P3.4	=	LCD E
;	P3.5	=
;	P3.6	=
;	P3.7	=
;
;	33995  =	68000084CB27
;	42790  =	680000A726E9
;	31257  =	6800007A190B
;	35122  =	6800008932D3
;	45459  =	680000B1934A
;	44880  =	680000AF5097
;	42604  =	680000A66CA2
```

```
;       42214  =    680000A4E62A
;       55861  =    680000DA3587
;       45715  =    680000B29349

;       60H    =    QUANTITY
;       61H    =    AMOUNT MSB
;       62H    =    AMOUNT LSB
;       63H    =    ITEM AMOUNT

;Program starts here

                  ORG    0000H          ;START
0000 120020                   LCALL   SYSTEM_INI
0003 120066                   LCALL        LCD_INI
0006 12023F                   LCALL   SERIAL_COMM_PORT_INITILIZE
0009 120084    WAIT_DSPLAY:   LCALL        PROJECT_DISPLAY
000C 20A7FA                   JB      P2.7,WAIT_DSPLAY
000F 1200D5    HERE:          LCALL        DISPLAY_AMOUNT
0012 12019A                   LCALL        READ_CARD
0015 1201A7                   LCALL        COMPARE_CARD_S
0018 1202DF                   LCALL        DO_CALCULATIONS
001B 12002F                   LCALL        BUZZER_ON
```

```
001E 80EF                 SJMP      HERE      ;Loop here after display
          ;-----------------------------------
0020 C287        SYSTEM_INI:        CLR    P0.7
0022 756000                  MOV    60H,#00H
0025 756100                  MOV    61H,#00H
0028 756200                  MOV    62H,#00H
002B 756300                  MOV    63H,#00H
002E 22                      RET
          ;-----------------------------------------------------------------------
002F D287        BUZZER_ON:         SETB   P0.7
0031 1200C5                  LCALL       DELAY
0034 C287                    CLR    P0.7
0036 22                      RET
          ;-----------------------------------------------------------------------
0037 120053  COMMAND: LCALL      READY     ;Write when display is not busy
003A F590                 MOV       P1,A      ;Command Character in Port P1
003C C2B2                 CLR       P3.2      ;Command resister chosen
003E C2B3                 CLR       P3.3      ; write enable
0040 D2B4                 SETB      P3.4      ; Strobe Character to display
0042 C2B4                 CLR       P3.4
0044 22                   RET        ;Return
          ;-----------------------------------------------------------------------
0045 120053          DISPLAY: LCALL       READY
```

```
0048 F590              MOV     P1,A      ;take data to be displayed
004A D2B2              SETB    P3.2     ;RS=P3.2= 1 to select data register
004C C2B3              CLR     P3.3      ;write enable
004E D2B4              SETB    P3.4     ;strobe character to be displayed
0050 C2B4              CLR     P3.4
0052 22                RET      ; Return
        ;------------------------------------------------------------------------
0053 C2B4          READY: CLR  P3.4     ;strobe display
0055 7590FF            MOV     P1,#0FFH  ;configure P1 for input
0058 C2B2              CLR     P3.2     ;Select command register
005A D2B3              SETB    P3.3    ;read enabled
005C C2B4          WAIT: CLR   P3.4     ;strobe display
005E D2B4              SETB    P3.4
0060 2097F9            JB   P1.7,WAIT  ;Read busy status (BF=0)
0063 C2B4              CLR     P3.4     ;end display strobe.
0065 22                RET     ;Return
        ;------------------------------------------------------------------------
0066 900074     LCD_INI:     MOV    DPTR,#COMM1       ; COMMAND REGISTER
OF LCD DISPLAY IS
0069 E4               UP1: CLR    A              ; INITIALISE BY COMM1 STRING
006A 93                MOVC    A,@A+DPTR
006B A3                INC     DPTR
006C B42401            CJNE    A,#'$',COMMAND1
```

```
006F 22                    RET
0070 1137         COMMAND1: ACALL   COMMAND
0072 0169              AJMP    UP1
0074 3C0E0601          COMM1:  DB 3CH,0EH,06H,01H,'$'
         ;---------------------------------------------------
0079 E4         LINE_DISPLAY:   CLR     A
007A 93                MOVC    A,@A+DPTR
007B A3                INC     DPTR
007C B42401            CJNE    A,#'$',DISPLAY1
007F 22                RET
0080 1145         DISPLAY1: ACALL   DISPLAY
0082 0179              AJMP    LINE_DISPLAY
         ;---------------------------------------------------
         PROJECT_DISPLAY:
0084 7401            MOV     A,#01H
0086 1137            ACALL   COMMAND
0088 7480            MOV     A,#80H
008A 1137            ACALL   COMMAND
008C 1200CE            LCALL         LONG_DELAY
008F 9000A3          MOV     DPTR,#LINE_01
0092 120079          LCALL   LINE_DISPLAY
0095 74C0            MOV     A,#0C0H
0097 1137            ACALL   COMMAND
```

```
0099 9000B4              MOV     DPTR,#LINE_02
009C 120079              LCALL   LINE_DISPLAY
009F 1200CE                LCALL         LONG_DELAY
00A2 22                  RET
            ;---------------------------------------------------
00A3 47504B3A              LINE_01:      DB 'GPK:- RFID BASED$'
00B4 2253484F              LINE_02:      DB '"SHOPING TROLLY"$'
            ;-------------------------------------------
00C5 7FFF          DELAY: MOV     R7,#0FFH
00C7 7EFF          LOOP1: MOV     R6,#0FFH
00C9 DEFE           LOOP: DJNZ    R6,LOOP
00CB DFFA                DJNZ    R7,LOOP1
00CD 22                  RET

            LONG_DELAY:
00CE 7D05                MOV     R5,#05H
00D0 11C5          P2251: ACALL   DELAY
00D2 DDFC                DJNZ    R5,P2251
00D4 22                    RET
            ;--------------------------------------------
            DISPLAY_AMOUNT:
00D5 7401                MOV     A,#01H
00D7 120037              LCALL   COMMAND
```

```
00DA 7480          MOV    A,#80H
00DC 120037        LCALL  COMMAND
00DF 20A00C          JB     P2.0,DIS_IN
00E2 744F            MOV   A,#'O'         ;1
00E4 120045          LCALL       DISPLAY
00E7 7454            MOV   A,#'T'         ;2
00E9 120045          LCALL       DISPLAY
00EC 800A            SJMP  DOWN_1
          DIS_IN:
00EE 7449            MOV   A,#'I'         ;1
00F0 120045          LCALL       DISPLAY
00F3 744E            MOV   A,#'N'         ;2
00F5 120045          LCALL       DISPLAY
          DOWN_1:
00F8 7420            MOV   A,#20H               ;3
00FA 120045          LCALL       DISPLAY
00FD 7454            MOV   A,#'T'         ;4
00FF 120045          LCALL       DISPLAY
0102 7451            MOV   A,#'Q'         ;5
0104 120045          LCALL       DISPLAY
0107 743D            MOV   A,#'='         ;6
0109 120045          LCALL       DISPLAY
010C E560            MOV   A,60H          ;7,8
```

```
010E 120188        LCALL     BCD2ASCII_DISPLAY
0111 7420          MOV   A,#20H          ;9
0113 120045        LCALL     DISPLAY
0116 7452          MOV   A,#'R'     ;10
0118 120045        LCALL     DISPLAY
011B 7473          MOV   A,#'s'     ;11
011D 120045        LCALL     DISPLAY
0120 743D          MOV   A,#'='     ;12
0122 120045        LCALL     DISPLAY
0125 E563          MOV   A,63H      ;13,14
0127 120188        LCALL     BCD2ASCII_DISPLAY
012A 7430          MOV   A,#'0'     ;15
012C 120045        LCALL     DISPLAY
012F 7430          MOV   A,#'0'     ;16
0131 120045        LCALL     DISPLAY
0134 74C0        MOV    A,#0C0H
0136 120037      LCALL   COMMAND
0139 7454          MOV   A,#'T'     ;1
013B 120045        LCALL     DISPLAY
013E 744F          MOV   A,#'O'     ;2
0140 120045        LCALL     DISPLAY
0143 7454          MOV   A,#'T'     ;3
0145 120045        LCALL     DISPLAY
```

```
0148 7441        MOV   A,#'A'        ;4
014A 120045      LCALL       DISPLAY
014D 744C        MOV   A,#'L'        ;5
014F 120045      LCALL       DISPLAY
0152 743D        MOV   A,#'='        ;6
0154 120045      LCALL       DISPLAY
0157 7452        MOV   A,#'R'        ;7
0159 120045      LCALL       DISPLAY
015C 7473        MOV   A,#'s'        ;8
015E 120045      LCALL       DISPLAY
0161 7420        MOV   A,#20H              ;9
0163 120045      LCALL       DISPLAY
0166 E561        MOV   A,61H         ;10,11
0168 120188      LCALL       BCD2ASCII_DISPLAY
016B E562        MOV   A,62H         ;12,13
016D 120188      LCALL       BCD2ASCII_DISPLAY
0170 7430        MOV   A,#'0'        ;14
0172 120045      LCALL       DISPLAY
0175 7430        MOV   A,#'0'        ;15
0177 120045      LCALL       DISPLAY
017A 742E        MOV   A,#'.'        ;16
017C 120045      LCALL       DISPLAY
017F 7420        MOV   A,#20H
```

```
0181 120045            LCALL      DISPLAY
0184 1200C5            LCALL      DELAY
0187 22                RET
          ;---------------------------------------------------------------------------
          ;BCD TO ASCII CONVERTER USED TO CONVERT 1 BCD NO IN 2 ASCII CODES AND DISPLAY IT:
          ;--------------------------------------------------------------
          BCD2ASCII_DISPLAY:
0188 FC                  MOV     R4,A              ;BCD TO ASCII CODE CONVERSION
0189 54F0              ANL    A,#0F0H       ;MASK LSB
018B C4                SWAP   A             ;SWAP NIBBLES
018C 4430              ORL    A,#30H        ;CONVERT IT TO ASCII
018E 120045              LCALL  DISPLAY
0191 EC                MOV    A,R4          ;TAKE THE ORIGINAL DATA
0192 540F              ANL    A,#0FH        ;MASK UPPER NIBBLE
0194 4430              ORL    A,#30H        ;CONVERT IT TO ASCII
0196 120045              LCALL  DISPLAY
0199 22                RET
          ;------------------------------------------------------------
          READ_CARD:
019A 7B0C            MOV    R3,#0CH     ;SET COUNTER 12
019C 7840            MOV    R0,#40H     ;SET INDIRECT ADDRRESSING
```

```
019E C298           CLR   SCON.0      ;CLEAR RI BIT
01A0 5152      LOAD:  ACALL  READ_COMM_PORT
01A2 F6             MOV   @R0,A
01A3 08             INC   R0
01A4 DBFA           DJNZ  R3,LOAD
01A6 22               RET
          ;------------------------------------------
          COMPARE_CARD_S:
01A7 90025D           MOV  DPTR,#CARD_RS_100_1
01AA 120229           LCALL       COMPARE_CARD
01AD B4FF04           CJNE  A,#0FFH,CARD_2
01B0 756301           MOV  63H,#01H
01B3 22               RET
          CARD_2:
01B4 90026A           MOV  DPTR,#CARD_RS_100_2
01B7 120229           LCALL       COMPARE_CARD
01BA B4FF04           CJNE  A,#0FFH,CARD_3
01BD 756301           MOV  63H,#01H
01C0 22               RET
          CARD_3:
01C1 900277           MOV  DPTR,#CARD_RS_200_1
01C4 120229           LCALL       COMPARE_CARD
01C7 B4FF04           CJNE  A,#0FFH,CARD_4
```

```
01CA 756302        MOV   63H,#02H
01CD 22            RET
         CARD_4:
01CE 900284        MOV   DPTR,#CARD_RS_200_2
01D1 120229        LCALL       COMPARE_CARD
01D4 B4FF04        CJNE  A,#0FFH,CARD_5
01D7 756302        MOV   63H,#02H
01DA 22            RET
         CARD_5:
01DB 900291        MOV   DPTR,#CARD_RS_300_1
01DE 120229        LCALL       COMPARE_CARD
01E1 B4FF04        CJNE  A,#0FFH,CARD_6
01E4 756303        MOV   63H,#03H
01E7 22            RET
         CARD_6:
01E8 90029E        MOV   DPTR,#CARD_RS_300_2
01EB 120229        LCALL       COMPARE_CARD
01EE B4FF04        CJNE  A,#0FFH,CARD_7
01F1 756303        MOV   63H,#03H
01F4 22            RET
         CARD_7:
01F5 9002AB        MOV   DPTR,#CARD_RS_400_1
01F8 120229        LCALL       COMPARE_CARD
```

```
01FB B4FF04         CJNE  A,#0FFH,CARD_8
01FE 756304         MOV   63H,#04H
0201 22             RET
          CARD_8:
0202 9002B8         MOV   DPTR,#CARD_RS_400_2
0205 120229         LCALL       COMPARE_CARD
0208 B4FF04         CJNE  A,#0FFH,CARD_9
020B 756304         MOV   63H,#04H
020E 22             RET
          CARD_9:
020F 9002C5         MOV   DPTR,#CARD_RS_500_1
0212 120229         LCALL       COMPARE_CARD
0215 B4FF04         CJNE  A,#0FFH,CARD_10
0218 756305         MOV   63H,#05H
021B 22             RET
          CARD_10:
021C 9002D2         MOV   DPTR,#CARD_RS_500_2
021F 120229         LCALL       COMPARE_CARD
0222 B4FF03         CJNE  A,#0FFH,D_RETURN
0225 756305         MOV   63H,#05H
0228 22       D_RETURN:RET
          ;------------------------------------------------------------------------
          COMPARE_CARD:
```

```
0229 7B0C              MOV    R3,#0CH     ;SET COUNTER 12
022B 7840              MOV    R0,#40H     ;SET INDIRECT ADDRRESSING
022D E6         NEXT_NO:MOV     A,@R0
022E F575              MOV   75H,A
0230 E4                CLR    A
0231 93                MOVC        A,@A+DPTR
0232 B57507            CJNE  A,75H,DENIED
0235 08              INC    R0
0236 A3              INC    DPTR
0237 DBF4            DJNZ   R3,NEXT_NO
0239 74FF              MOV   A,#0FFH            ;CARD_MATCH
023B 22                RET
          DENIED:
023C 7400              MOV   A,#00H
023E 22                RET
          ;--------------------------------------------------------------------------
          SERIAL_COMM_PORT_INITILIZE:
023F 758DFD          MOV    TH1,#0FDh     ;set th1 countewr as 0fdh
0242 758BFD          MOV    TL1,#0FDh     ;set th1 countewr as 0fdh
0245 530D7F          ANL    PCON,#7Fh     ;SET SMOD = 0
0248 759870          MOV      SCON,#70h        ;SET UART IN MODE 1, ENABLE
SRECIVE MODE
```

```
024B 758920           MOV    TMOD,#20h      ;START THE TIMER IN MODE 2  I.E
AUTO RELOAD MODE

024E 758840           MOV    TCON,#40H      ;START THE TIMER 1

0251 22               RET

          ;-------------------------------------------------------

          READ_COMM_PORT:

0252 109803           JBC    SCON.0,RECEIVE  ;CHECK RI BIT

0255 00               NOP

0256 80FA             SJMP   READ_COMM_PORT

          RECEIVE:

0258 C298             CLR    SCON.0         ;CLEAR RI BIT

025A E599             MOV    A,SBUF         ;SEND DATA TO PORT 1

025C 22               RET

          ;-------------------------------------------------------

025D 36383030           CARD_RS_100_1:   DB   '68000084CB27$'

026A 36383030           CARD_RS_100_2:   DB   '680000A726E9$'

0277 36383030           CARD_RS_200_1:   DB   '6800007A190B$'

0284 36383030           CARD_RS_200_2:   DB   '6800008932D3$'

0291 36383030           CARD_RS_300_1:   DB   '680000B1934A$'

029E 36383030           CARD_RS_300_2:   DB   '680000AF5097$'

02AB 36383030           CARD_RS_400_1:   DB   '680000A4E62A$'

02B8 36383030           CARD_RS_400_2:   DB   '680000A66CA2$'

02C5 36383030           CARD_RS_500_1:   DB   '680000DA3587$'
```

```
02D2 36383030       CARD_RS_500_2:  DB    '680000B29349$'
        ;--------------------------------------------------
        DO_CALCULATIONS:
02DF 20A015                 JB    P2.0,ITEAM_IN
02E2 E560                   MOV   A,60H
02E4 B40009                 CJNE  A,#00H,DO_ACTION
02E7 D287                   SETB  P0.7
02E9 30A0FD     WAIT_1:          JNB   P2.0,WAIT_1
02EC 756300                 MOV   63H,#00H
02EF 22                     RET
02F0 1202FE     DO_ACTION:LCALL      TQ_DEC
02F3 12030E                 LCALL      T_AMOUNT_SUBTRACT
02F6 22                     RET
        ITEAM_IN:
02F7 120306                 LCALL      TQ_INC
02FA 120329                 LCALL      T_AMOUNT_ADD
02FD 22                     RET
        ;--------------------------------------------------
02FE E560       TQ_DEC:          MOV   A,60H
0300 2499                   ADD   A,#99H
0302 D4                     DA    A
0303 F560                   MOV   60H,A
0305 22                     RET
```

```
              ;------------------------------------------------
0306 E560     TQ_INC:        MOV   A,60H
0308 2401              ADD   A,#01H
030A D4                DA    A
030B F560              MOV   60H,A
030D 22                RET
              ;------------------------------------------------
              T_AMOUNT_SUBTRACT:
030E A963              MOV   R1,63H
0310 E562     UP_SUB:        MOV   A,62H
0312 2499              ADD   A,#099H
0314 D4                DA    A
0315 F562              MOV   62H,A
0317 B4000C            CJNE  A,#00H,D151

031A E561              MOV   A,61H
031C B40002            CJNE  A,#00H,DOWN_4
031F 8005              SJMP  D151
0321 2499     DOWN_4:        ADD   A,#099H
0323 D4                DA    A
0324 F561              MOV   61H,A
0326 D9E8     D151:    DJNZ  R1,UP_SUB
0328 22                RET
```

```
                    ;----------------------------------------------------
0329 E562      T_AMOUNT_ADD:  MOV   A,62H
032B A963                     MOV   R1,63H
032D 29                       ADD   A,R1
032E D4                       DA    A
032F F562                     MOV   62H,A
0331 5007                     JNC   D15

0333 E561                     MOV   A,61H
0335 2401                     ADD   A,#01H
0337 D4                       DA    A
0338 F561                     MOV   61H,A
033A 22        D15:           RET
```

Chapter 7

Project Output

7.1 Cart with Micro-controller,RFID & Zigbee(Tx.)

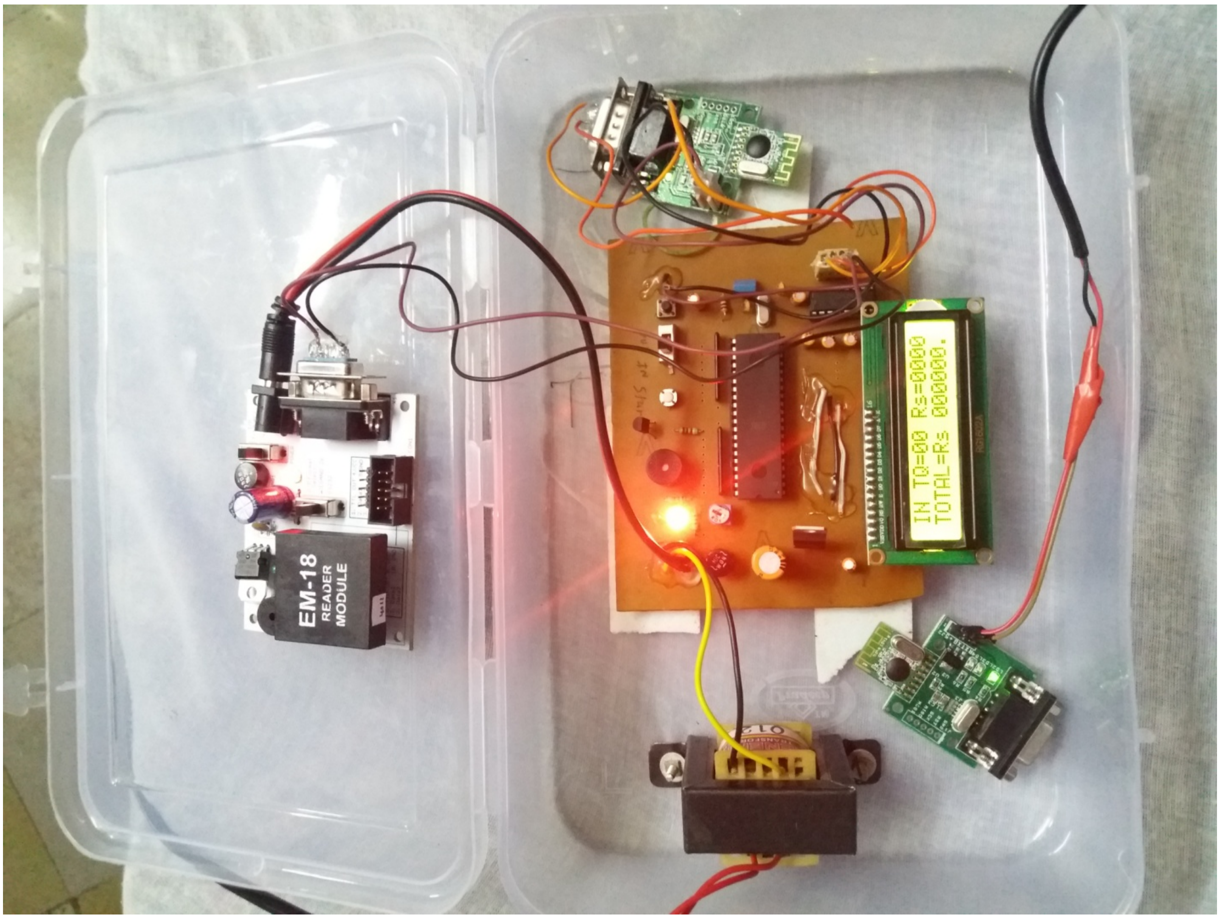


fig- IN Operation (Adding products to cart)

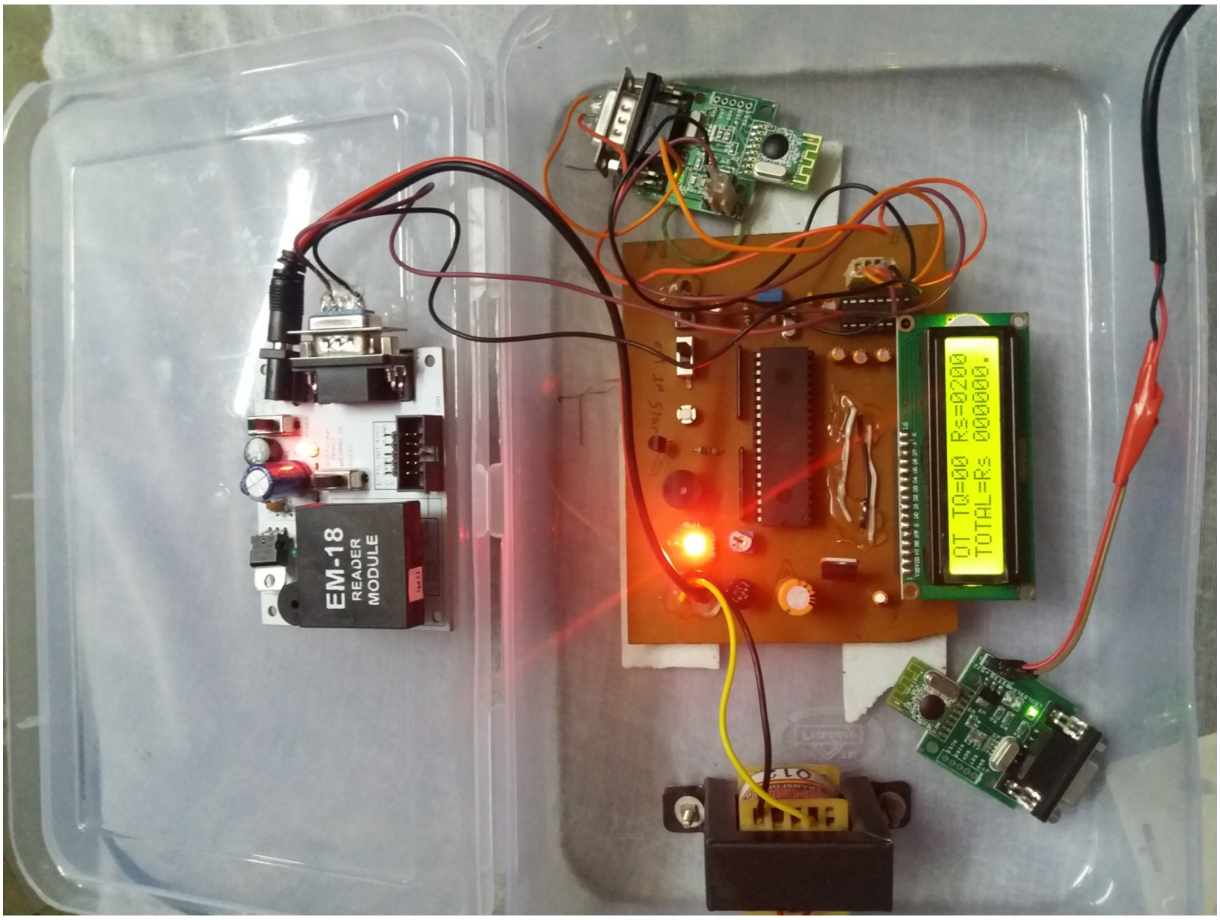
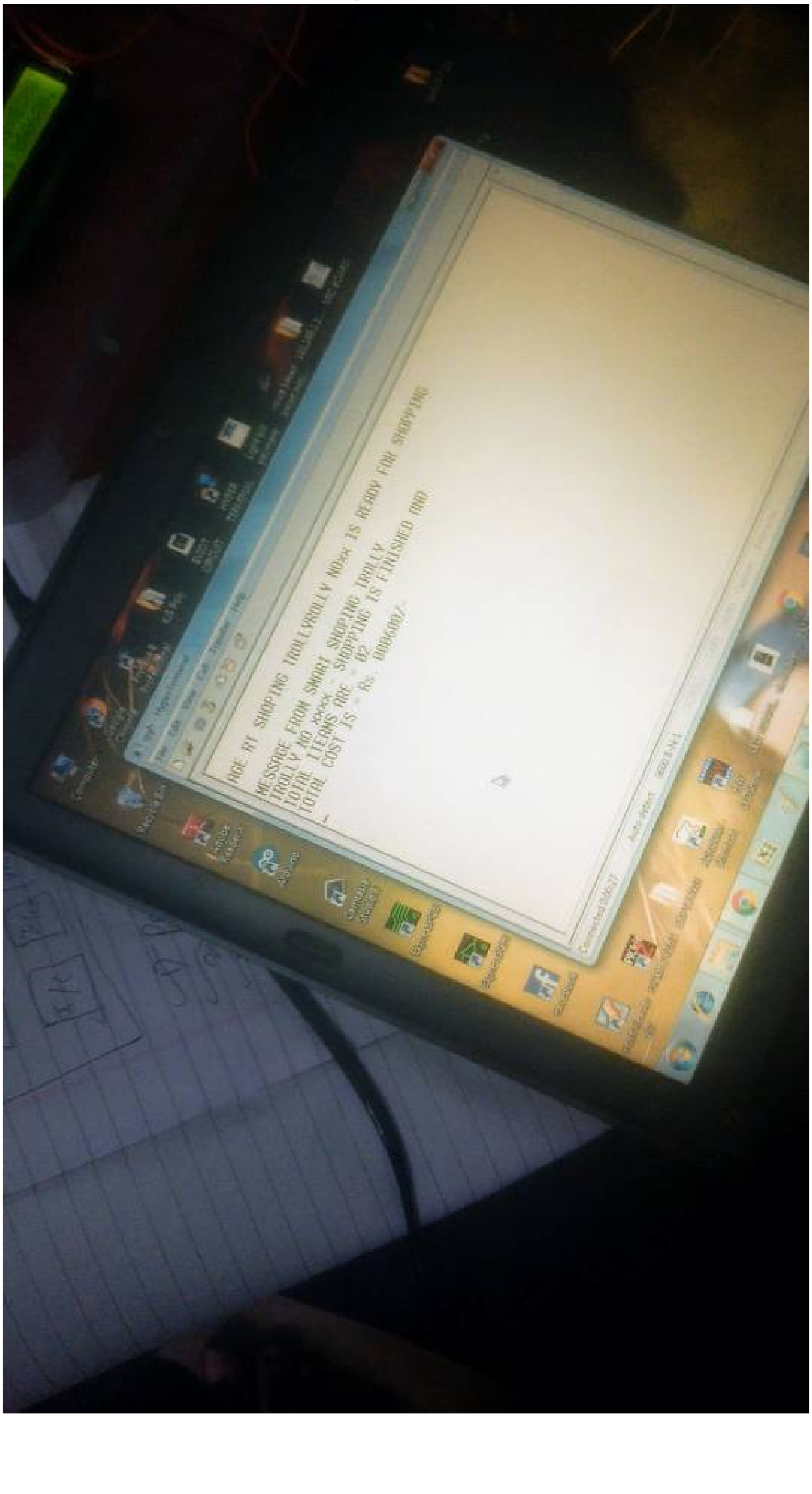


fig-OUT Operation (Removing products from cart)

7.2 Seller side with Zigbee(Rx.),Serial comm PC



.....(seller side).

Chapter 8

Conclusion & Future Scope

8.1 Conclusion

The intended objectives were successfully achieved in the prototype model developed. The developed product is easy to use, economical and does not require any special training. Though the project showcases the proof of concept, there are a few aspects that can be included to make the smart shopping cart more robust. To begin with, in this project the latency time of the wireless communication with the server may need to be considered. Secondly, the communication is very much restricted to a low distance through use of zigbee. This issue will have to be resolved specifically with respect to billing to promote consumer confidence. Further, a more sophisticated micro-controller and larger display system can be used to provide better consumer experience.

8.2 Future Scope

- Zigbee modules can be interfaced to achieve inventory management for shops.
- Inventory status of the products can also be updated at the end of shopping.
- Centralized database system for storing the product informations.

Chapter 9

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