WIRELESS COMMUNICATION BETWEEN TWO PCs BY SERIAL PORT USING INFRARED

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MAY-2006

Submitted in partial fulfillment of the degree of bachelor of Technology

DEPARTMENT OF ELECTRONICS AND COMMUNICATION
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CERTIFICATE

This is to certify that the work entitled, "Wireless communication between two PCs by serial port using infrared" submitted by Dhawal Dhal, Rishi Sand and Atul Kumar Gupta in partial fulfillment for the award of degree of bachelor of technology in Electronics and Communication of Jaypee University of Information Technology has been carried out under my supervision. This work has not been submitted Partially or wholly to any other University or institute for the award of this or any other degree or diploma.

Ms Jyoti Kedia
Project Instructor

ACKNOWLEDGEMENT

Many people have contributed to this project in a variety of ways over the past few months. We also acknowledge the many helpful comments received from other teachers of the different departments and visualization courses and seminars. I are indebted to all those who provided reviews and suggestions for improving the materials and topics covered in our package, and I extend our apologies to anyone we may have failed to mention.

Thank You

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LIST OF ABBREVIATIONS

PC	Personal Computer
LAN	Local Area Networks
GPS	Global Positioning System
GSM	Global System for Mobile Communication
GPRS	General Packet Radio Service
EDGE	Enhanced Data GSM Environment
UMTS	Universal Mobile Telecommunications System
WAP	Wireless Application Protocol
PAN	Personal Area Networks
IEEE	Institute of Electrical and Electronics Engineers
WANDA	Wireless Any Network Digital Assistant
CDMA	Code Divison Multiple Access
TDMA	Time Divison Multiple Access
IR	Infrared
Kbps	Kilo bits per second
K	Kilo
F	Farad
HVDC	High Voltage Direct Current

ABSTRACT

Infrared beams can be used to establish high speed digital links between portable terminals and a base station, allowing construction of in-building wireless local area networks. Using serial port Infrared communication we have developed a wireless local area network. The serial port wireless communication help achieve communication between two computers. The RS232 port of the computer is used to make it possible. Wireless Communication is now widely used all over the world whether its in the form of mobile communication or wireless LANs .The future communication emphasize more research on wireless communication and what needs to be done is to reduce errors in this form of communication as the disparity associated with wireless communication is of significant level and needs to be checked in order to have safe and secure transmission. Using serial port and the infrared technique we have made the circuitry so that two computers can interact with each other without the use of wire between them. This has helped us establish communication without the use of wires and which is the most modern form of communication technique. The infrared technique is now-a-days also used in mobile equipments where infrared ports are provided in the equipments so as to transfer the data between them.

INTRODUCTION

Infra radiation is an attractive transmission medium for wireless indoor access to Local Area Networks. The most important advantages offered by infrared over radio are the availability of unlimited, unregulated spectrum and the fact that infrared does not pass through and other opaque barriers. Single infrared links can operate with bit rates as high as 100 Mbps. Since it is possible to operate one infrared link in every room of a building without interference, the potential capacity of an infrared network is extremely high. The propagation characteristics of infrared radiation are similar to those of radio, in that if one measured the received power versus position using a detector much smaller than the wavelength, one would record substantial fluctuations of received power level, i.e, multi-path fading. In practical infrared systems however the detector size is much larger than the wavelength, so that such power fluctuations are averaged out effectively. Using RS232 serial port of the computer transmitter and receiver can be attached to the it in order to achieve communication with the computer via serial port. The serial port make its possible for the computer to interact with the outer devices which are attached externally to the computer which can be in the form of any other circuitry as in our case we have used infrared transmission and reception technique to achieve wireless communication between two computers. The circuit at the transmitting end of the computer actually receives the data from the computer and then via infrared transmits it to the receiving TSOP which then transmits it to the receiving computer.

WIRELESS TECHNOLOGIES

Wireless is a term used to describe telecommunications in which electromagnetic waves (rather than some form of wire) carry the signal over part or all of the communication path. Some monitoring devices, such as intrusion alarms, employ acoustic waves at frequencies above the range of human hearing; these are also sometimes classified as wireless.

The first wireless transmitters went on the air in the early 20th century using radiotelegraphy (Morse code). Later, as modulation made it possible to transmit voices and music via wireless, the medium came to be called "radio." With the advent of television, fax, data communication, and the effective use of a larger portion of the spectrum, the term "wireless" has been resurrected.

Common examples of wireless equipment in use today include:

- Cellular phones and pagers -- provide connectivity for portable and mobile applications, both personal and business

- Global Positioning System (GPS) -- allows drivers of cars and trucks, captains of boats and ships, and pilots of aircraft to ascertain their location anywhere on earth

- Cordless computer peripherals -- the cordless mouse is a common example; keyboards and printers can also be linked to a computer via wireless

- Cordless telephone sets -- these are limited-range devices, not to be confused with cell phones

- Home-entertainment-system control boxes -- the VCR control and the TV channel control are the most common examples; some hi-fi sound systems and FM broadcast receivers also use this technology

- Remote garage-door openers -- one of the oldest wireless devices in common use by consumers; usually operates at radio frequencies

- Two-way radios -- this includes Amateur and Citizens Radio Service, as well as business, marine, and military communications

- Baby monitors -- these devices are simplified radio transmitter/receiver units with limited range

- Satellite television -- allows viewers in almost any location to select from hundreds of channels

- Wireless LANs or local area networks -- provide flexibility and reliability for business computer users

Wireless technology is rapidly evolving, and is playing an increasing role in the lives of people throughout the world. In addition, ever-larger numbers of people are relying on the technology directly or indirectly. (It has been suggested that wireless is overused in some situations, creating a social nuisance.) More specialized and exotic examples of wireless communications and control include:

- Global System for Mobile Communication (GSM) -- a digital mobile telephone system used in Europe and other parts of the world; the de facto wireless telephone standard in Europe

- General Packet Radio Service (GPRS) -- a packet-based wireless communication service that provides continuous connection to the Internet for mobile phone and computer users

- Enhanced Data GSM Environment (EDGE) -- a faster version of the Global System for Mobile (GSM) wireless service

- Universal Mobile Telecommunications System (UMTS) -- a broadband, packet-based system offering a consistent set of services to mobile computer and phone users no matter where they are located in the world

- Wireless Application Protocol (WAP) -- a set of communication protocols to standardize the way that wireless devices, such as cellular telephones and radio transceivers, can be used for Internet access

- i-Mode -- the world's first "smart phone" for Web browsing, first introduced in Japan; provides color and video over telephone sets

Wireless can be divided into:

- Fixed wireless -- the operation of wireless devices or systems in homes and offices, and in particular, equipment connected to the Internet via specialized modems
- Mobile wireless -- the use of wireless devices or systems aboard motorized, moving vehicles; examples include the automotive cell phone and PCS (personal communications services)
- Portable wireless -- the operation of autonomous, battery-powered wireless devices or systems outside the office, home, or vehicle; examples include handheld cell phones and PCS units

- IR wireless -- the use of devices that convey data via IR (infrared) radiation; employed in certain limited-range communications and control systems

1.Bluetooth

Bluetooth is a short-range wireless technology used to create PANs (Personal Area Networks) enabling seamless voice and data connections between both mobile and stationary devices. For instance, it specifies how mobile phones, WIDs, (Wireless information device: a PDA or similar-sized pocket computing device with built-in wireless connectivity, and that hence permits direct mobile access to the Internet without having to be interfaced to a mobile phone) and computers interconnect with each other, with computers, and with office or home phones. Bluetooth allows you to leave your phone in your pocket, while talking on your phone with a Bluetooth headset - with no wires. You can also exchange contact or scheduling information with other Bluetooth enabled phones nearby, or send such information to a nearby Bluetooth-enabled printer. Another common use is to give a laptop computer or a PDA (Personal Digital Assistant) wireless high-speed Internet access via Bluetooth and your phone. Many newer automobiles also have Bluetooth, which can interface with a phone in a pocket, to allow automatic hands-free phone capability. More innovative uses include playing a game against someone with a similar phone nearby. Version 1.0 requires users to register the connection between the 2 devices while version 1.1 allows a Bluetooth device to communicate with up to 8 devices.

2. Wi-Fi (802.11b 802.11g) Wireless Ethernet

Wi-Fi, short for "wireless fidelity", is the popular term for a high-frequency wireless local area network (WLAN). Wi-Fi is specified in the 802.11b specification from the Institute of Electrical and Electronics Engineers (IEEE) and is part of a series of wireless specifications together with 802.11, 802.11a and 802.11g. All four standards use the Ethernet protocol. Products certified as Wi-Fi by Wireless Ethernet Compatibility Alliance (WECA) are interoperable with each other even if they are from different manufacturers. A user with a Wi-Fi product can use any brand of Access Point with any

other brand of client hardware that is built to the Wi-Fi standard at the 2.4 ghz spectrum using direct sequence spectrum (DSS).

Unless adequately protected, a Wi-Fi wireless LAN can be susceptible to access from the outside by unauthorized users. Companies that have a wireless LAN are urged to add security safeguards such as the Wired Equivalent Privacy (WEP) encryption standard, the setup and use of a virtual private network (VPN) and a firewall. Many airports, hotels, and fast-food facilities now offer public access to a Wi-Fi network; these are known as hotspots. Although many charge a daily or hourly rate for access, some are free.

3. GSM/GPRS

GSM, short for Global System for Mobile communication, is one of the leading digital mobile telephone systems widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA), which allows eight simultaneous calls on the same radio frequency, and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). It operates at either the 900 MHz or 1800 MHz frequency band. GSM has over 120 million users worldwide and is available in 120 countries. Because many GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries. American Personal Communications (APC), a subsidiary of Sprint, is using GSM as the technology for a broadband personal communications service (PCS). This service will ultimately have more than 400 base stations for the palm-sized handsets that are being made by Ericsson, Motorola, and Nokia. The handsets include a phone, a text pager, and an answering machine. GSM together with other technologies is part of an evolution of wireless mobile telecommunication that includes High-Speed Circuit-Switched Data (HCSD), General Packet Radio Services (GPRS), Enhanced Data GSM Environment (EDGE), and Universal Mobile Telecommunications Service (UMTS). GPRS is a packet-based wireless communication service that promises data rates from 56 up to 114 Kbps, compared with current system's 9.6 kilobits, and continuous connection to the Internet for mobile phone and computer users. GPRS, which supports a wide range of bandwidths, is

an efficient use of limited bandwidth and is particularly suited for sending and receiving small bursts of data, such as e-mail and Web browsing, as well as large volumes of data. The higher data rates will allow users to take part in video conferences and interact with multimedia Web sites and similar applications using mobile handheld devices as well as notebook computers. GPRS is based on GSM communication and will complement existing services such circuit-switched cellular phone connections and the Short Message Service (SMS). GPRS will also complement. GPRS is an evolutionary step toward Enhanced Data GSM Environment (EDGE) and Universal Mobile Telephone Service (UMTS).

4. WANDA

WANDA, short for Wireless Any Network Digital Assistant, is a new "triwireless" PDA concept designed by TI (Texas Instruments). A Pocket PC-based PDA, the WANDA supports GSM/GPRS cell networks, Bluetooth, and Wi-Fi. WANDA is a modular architecture so it can support one, two or all three of the wireless capabilities TI to enable simultaneous phone calls, web browsing, mobile commerce or printing by combining 802.11b and Bluetooth wireless capabilities, along with a GSM/GPRS tri-band radio, into a single low-power handset design. It sports Microsoft's Pocket PC operating system.

5. Infrared

Infrared (IR) is a type of light that is not visible to the human eye. A transmitter produces rapid pulses of IR light in specific patterns, which a receiver can interpret. Our most likely use of IR for communication on a daily basis is our television remote. The transmitter sends IR messages in "packets." Each packet consists of a specific "header" followed by the "payload" or actual data. The packet ends with a checksum, which is a method of verifying that the data was read correctly. The header is there so that the receiver knows where the packet starts. When you send a message from one device to another, the payload is two bytes long: the first just indicates that the second byte is a message. Infrared technology allows computing devices to communicate via short-range wireless signals. Computer infrared network adapters both transmit and receive data

through ports on the rear or side of a device. Infrared networks were designed to support direct two-computer connections only, created temporarily as the need arises.

Figure1:Infrared Transmission

Range - Infrared communications span very short distances. Place two infrared devices within a few feet (no more than 5 meters) of each other when networking them. Unlike Wi-Fi and Bluetooth technologies, infrared network signals cannot penetrate walls or other obstructions and work only in the direct "line of sight."

Problems with IR

IR is a fairly cheap and easy way for two things to communicate. However, it does have a number of problems, including:

- The sun! The sun gives off a lot of infrared light. In direct sunlight, the IR receiver can be "flooded" and won't be able to see any incoming messages. To work around this, always use your Mindstorms indoors and out of direct sunlight.

- Line-of-sight. You may know from experience that you need to point a TV remote control directly at the TV for it to work. If you point the remote in some other direction, or if you put your hand between the remote and the TV, chances are the remote will stop working. Similarly, if you want to have two RCX bricks talk to each other, they need to be pointed roughly at each other. As long as both devices are in the same room and nothing is in between them, they are still able to communicate, so this isn't as big a problem as it might seem.

- One-byte payloads- As mentioned above, only messages that are one byte long can be transferred. As a consequence, sending complex messages becomes challenging.

SERIAL PORT RS-232

Electronic data communications between elements will generally fall into two broad categories: single-ended and differential. RS232 (single-ended) was introduced in 1962, and despite rumors for its early demise, has remained widely used through the industry.
RS stands for recommended standard. In the 60's a standards committee now known as the Electronic Industries Association developed an interface to connect computer terminals to modems. Over the years this has been updated: the most commonly used version of the standard is RS232C (sometimes known as EIA232); the most recent is RS232E.
The standard defines low-cost serial communication in a robust way where bits are sent sequentially. It was originally defined for connecting devices such as computers, terminals and printers to modems. This equipment is connected through their serial port. The original serial port definition limited the maximum transfer speed to 20 kbps, but practice has shown that higher bandwidth is possible. To overcome these limitations, the RS232-E standard allows much higher communication speeds than its predecessor. Independent channels are established for two-way (full-duplex) communications. The RS232 signals are represented by voltage levels with respect to a system common (power / logic ground). The "idle" state (MARK) has the signal level negative with respect to common, and the "active" state (SPACE) has the signal level positive with respect to common.

The RS-232 interface presupposes a common ground between the DTE and DCE. This is a reasonable assumption when a short cable connects the DTE to the DCE, but with longer lines and connections between devices that may be on different electrical busses with different grounds, this may not be true.

RS232 data is bi-polar.... +3 TO +12 volts indicates an "ON or 0-state (SPACE) condition" while -3 to -12 volts indicates an "OFF" 1-state (MARK) condition.... Modern computer equipment ignores the negative level and accepts a zero voltage level as the "OFF" state. In fact, the "ON" state may be achieved with lesser positive potential. This means circuits powered by 5 VDC are capable of driving RS232 circuits directly,

however, the overall range that the RS232 signal may be transmitted/received may be dramatically reduced.

The output signal level usually swings between +12V and -12V. The "dead area" between +3v and -3v is designed to absorb line noise. In the various RS-232-like definitions this dead area may vary. For instance, the definition for V.10 has a dead area from +0.3v to -0.3v. Many receivers designed for RS-232 are sensitive to differentials of 1v or less.

This can cause problems when using pin powered widgets - line drivers, converters, modems etc. These types of units need enough voltage and current to power themselves up.

An RS-232 port can supply only limited power to another device. The number of output lines, the type of interface driver IC, and the state of the output lines are important considerations.

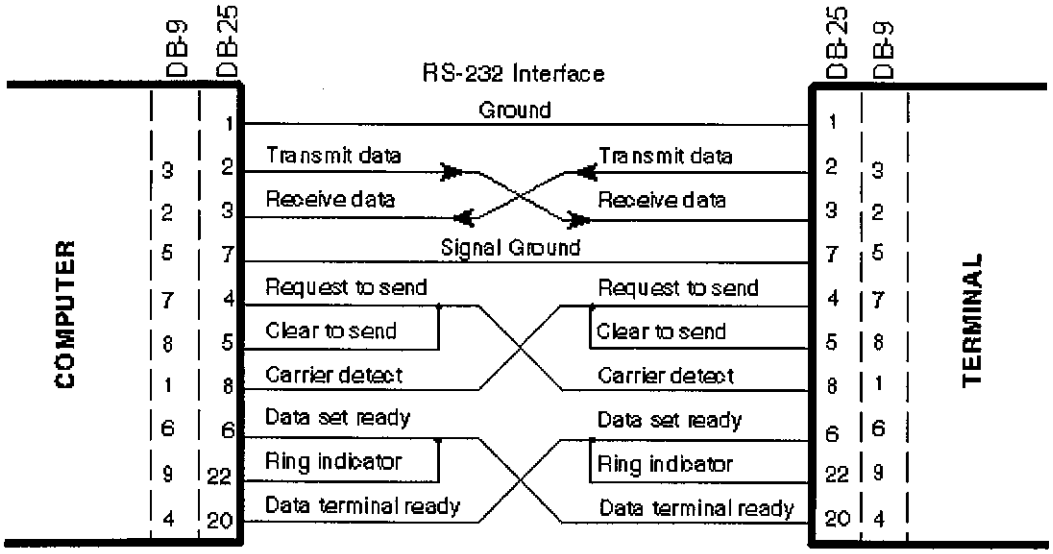

Figure2:Direct to Computer RS-232 Interface

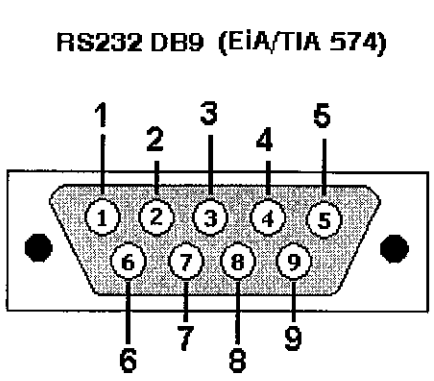

Figure3: Male Connector

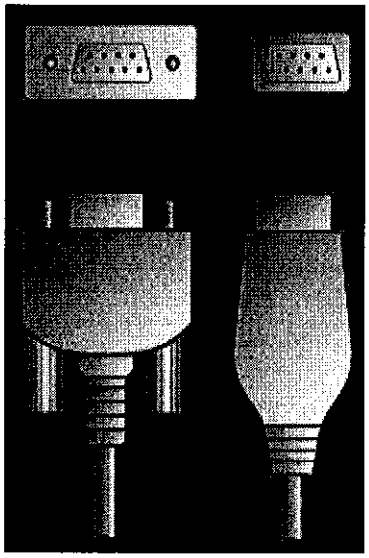

Figure4: Male Female Connectors

CIRCUIT DIAGRAM

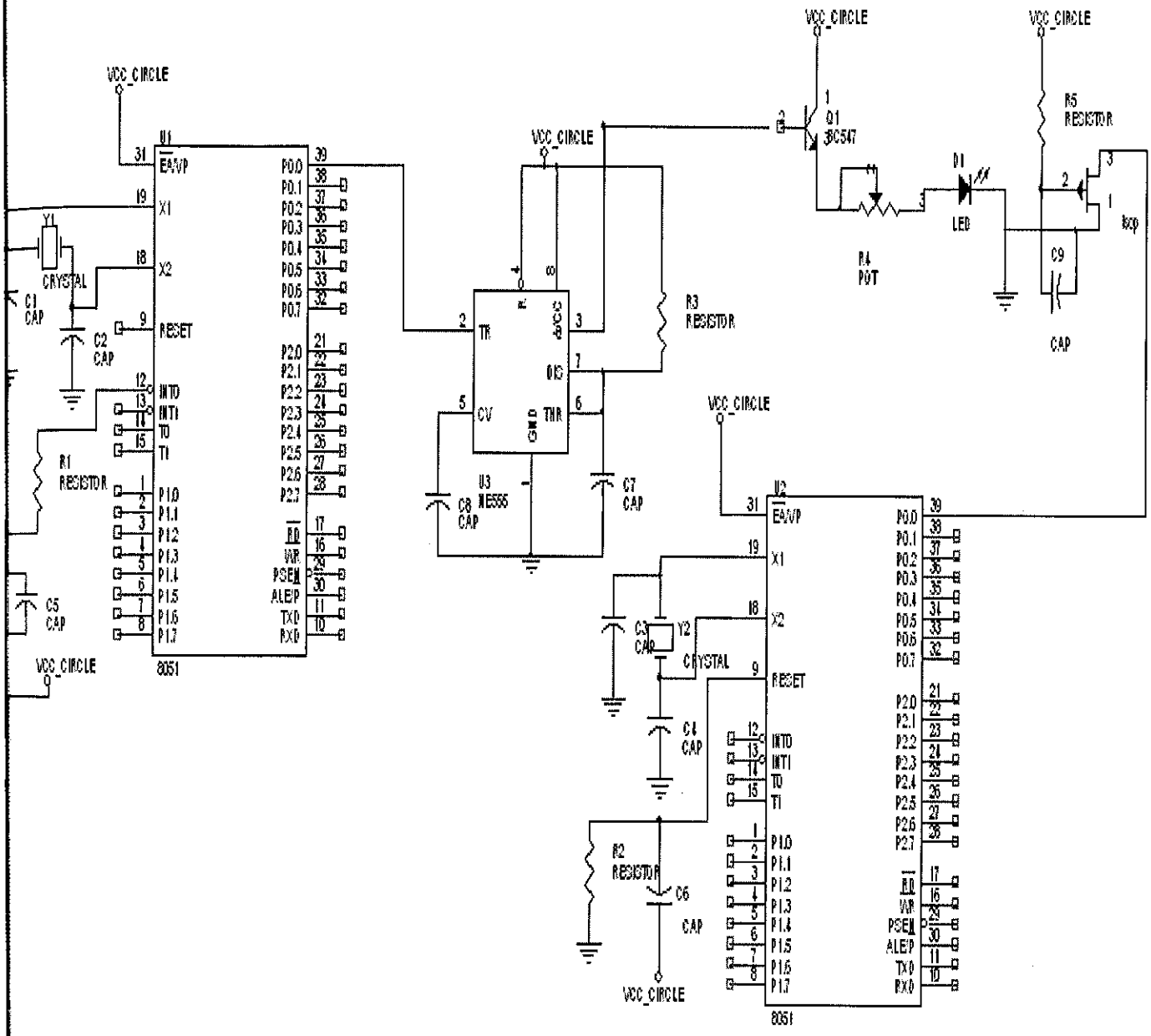

Figure 5: Circuit Diagram

The circuit shows infra red communication between two personal computers. The data between the two computers is sent through infra red. The data to be sent is coded in the form of pulses which drive the infra red led. An infra red receiver on the other side receives these infra red pulses. These pulses are then decoded and sent to the pc.

In this system there are two computers; one is the master computer which sends the commands. The other computer is the slave computer which receives the commands sent by the master computer. Microcontroller acts as an encoder and decoder. On the transmitter side the computer sends the data through its serial port. This data has to be captured by the controller, then encoded and sent to the infra red channel. Since RS232 and TTL levels are different so a computer and a microcontroller would not be able to communicate between themselves. For this MAX232 IC is used as a level shifter which shifts the levels of TTL signal into RS232 and vice versa.
After shifting the level the data is sent to the microcontroller. At89c52 microcontroller is used. It receives the data from the computer serial port, encodes it and sends the output in the form of pulses.

555 timer is used as a mono-stable multi-vibrator. Whenever it receives an input pulse, it pulses its output in the negative direction of input that is, a negative pulse at the input is changed into positive pulse at output and vice versa. These pulses are used to switch the infra red led. An infrared receiver receives the data and sends the output to the receiver microcontroller. This microcontroller, again an AT89C52 decodes the data. Again for sending the data to the slave computer, the level of the data has to be shifted from TTL to RS232 again max232 is used and data is sent to the computer through its serial port.

CIRCUIT COMPONENTS: DESCRIPTION

RESISTANCES 10K, 100Ohm, 5 KOhm

CAPACITOR 10 MicroF, 1 MicroF, 1000 MicroF

IC: MAX 232

- Operate With Single 5-V Power Supply
- Operate Up to 120 kbit/s
- Two Drivers and Two Receivers
- (+-)30-V Input Levels
- Low Supply Current 8 mA Typical
- Designed to be Interchangeable With Maxim MAX232

Applications

- Battery-Powered Systems
- Terminals
- Modems
- Computers

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply EIA-232 voltage levels from a single 5-V supply. Each receiver converts EIA-232 inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V and a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL/CMOS input levels into EIA-232 levels.

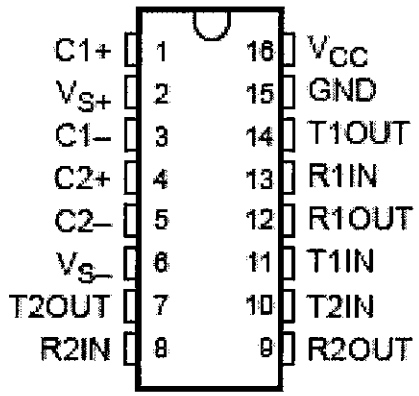

Figure6: Pin Diagram MAX232

LM7805

3-Terminal 1A Positive Voltage Regulator

Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

Description

- The MC78XX/LM78XX/MC78XXA series of three terminal positive regulators are available in the O-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

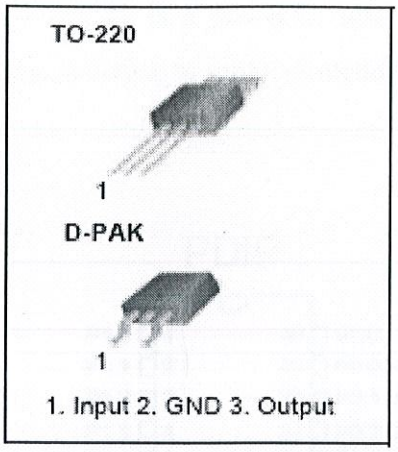

Figure7: External View of LM7805

AT89C51

Features

- 4K Bytes of In-System Reprogrammable Flash Memory
- Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Programmable Serial Channel
- Low-power Idle and Power-down Modes

Description

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a

monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

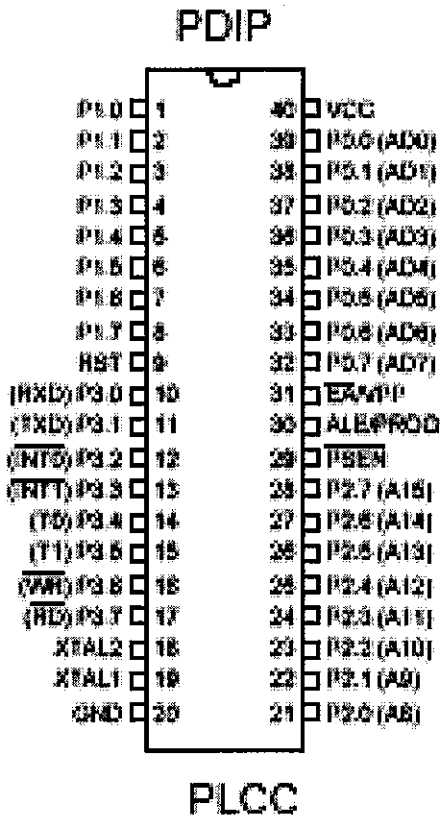

Figure8: Pin Diagram of AT89C51

The AT89C51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT89C51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The Power-down Mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset.

Port 1

Port 1 is an 8-bit bi-directional 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 pullups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pullups. Port 1 also receives the low-order address bytes during Flash programming and verification.

Port 2

Port 2 is an 8-bit bi-directional 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 bi-directional 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 pullups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pullups. Port 3 also serves the functions of various special features of the AT89C51 as listed below: Port 3 also receives some control signals for Flash programming and verification.

Port	**Alternate Functions**
P3.0	RXD(serial input port)
P3.1	TXD(serial output port)
P3.2	INT0(external interrupt 0)

P3.3	INT1(external interrupt 1)
P3.4	T0(timer 0external input)
P3.5	T!(timer 1 external input)
P3.6	WR(external data memory write strobe)
P3.7	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 ALEpulse 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.

Oscillator Characteristics

XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier which can be configured for use as an on-chip oscillator, as shown in Figure 1. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, XTAL2 should be left unconnected while XTAL1 is driven as shown in Figure 2. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clocking circuitry is through a divide-by-two flip-flop, but minimum and maximum voltage high and low time specifications must be observed.

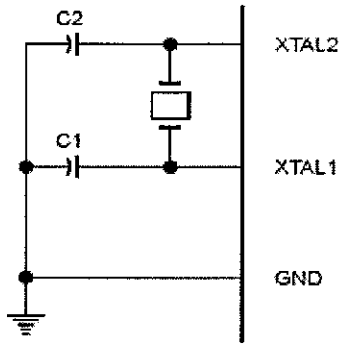

Figure 9: Oscillator Connections

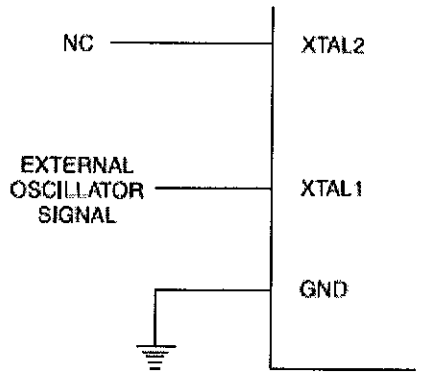

Figure 10: External Clock Drive Configuration

Idle Mode

In idle mode, the CPU puts itself to sleep while all the onchip peripherals remain active. The mode is invoked by software. The content of the on-chip RAM and all the special functions registers remain unchanged during this mode. The idle mode can be terminated by any enabled interrupt or by a hardware reset. It should be noted that when idle is terminated by a hard ware reset, the device normally resumes program execution, from where it left off, up to two machine cycles before the internal reset algorithm takes control. On-chip hardware inhibits access to internal RAM in this event, but access to the port pins is not inhibited. To eliminate the possibility of an unexpected write to a port pin when Idle is terminated by reset, the instruction following the one that invokes Idle should not be one that writes to a port pin or to external memory.

Microcontroller Transmitter Code

```
#include <REG52.h>
#include <stdio.h>
#include <math.h>
#include <absacc.h>
#include <ctype.h>
#include <stdlib.h>


void delay();
void getkey();

main()
{
                TMOD=0x20;
                    TH1=0xFD;                   //timer 1 in auto-reload mode
                    SCON=0x50;                  // baud rate 9600,n,8,1
                    TR1=1;                              //run timer
                            P1=0xff;


                    while(1)
                    {
                     getkey();
                     }

}

void getkey(void)
{
        char temp;
```

```
if (RI==1)
 {
   temp=SBUF;
         RI=0;

                    if(temp==0x01)
                    {
                      P10=0;
                           delay();
                           P10=1;
                    }
                          if(temp==0x02)
                    {
                      P10=0;
                           delay();
                           P10=1;
                           delay();
                           P10=0;
                           delay();
                           P10=1;
                    }
                    if(temp==0x03)
                    {
                      P10=0;
                           delay();
                           P10=1;
                           delay();
                           P10=0;

                           delay();
                           P10=1;
```

```
                    delay();
                    P10=0;
                    delay();
                    P10=1;
                }
            }
        }

void delay(void)
{
  int i,j;
  for(i=0;i<500;i++)
  {
    for(j=0;j<500;j++)
        {
        ;
        }
      }
}
```

Microcontroller Receiver Code

```
#include <REG52.h>
#include <stdio.h>
#include <math.h>
#include <absacc.h>
#include <ctype.h>
#include <stdlib.h>


void delay();
void getkey();
void trans_key(char temp);
char temp;

main()
{
                TMOD=0x20;
                    TH1=0xFD;                    //timer 1 in auto-reload mode
                    SCON=0x50;                  // baud rate 9600,n,8,1
                    TR1=1;                              //run timer
                    P1=0xff;


                    while(1)

                    {
                     SBUF=temp;
                TI=0;
                     getkey();
                    }
```

```
}

void getkey()
{
                if(P10==0)
                {
                 delay();
                 temp=temp+1;
                }
                trans_key(temp);
}

void trans_key(char temp1)
{
    temp1=temp;

          if(temp1==0x01)
          {
           SBUF=0x01;
                TI=0;
                delay();
          }
           if(temp1==0x02)
          {
           SBUF=0x02;
                TI=0;
               delay();
          }
     if(temp1==0x03)
          {
           SBUF=0x03;
```

```
                TI=0;
                delay();
            }
              if(temp1==0x04)
            {
             temp=0x00;
                delay();
            }

}

void delay(void)

{
  int i,j;
  for(i=0;i<500;i++)
  {
    for(j=0;j<500;j++)
          {
          ;
          }
        }
}
```

Transformer

We have used a 6V step down transformer which converts 220V AC in to 6V

A transformer is an electrical device that transfers energy from one circuit to another by magnetic coupling with no moving parts .Input is connected to the primary winding and load is connected to the secondary winding and there is no connection between input and output that is they are in isolation. A transformer comprises two or more coupled windings, or a single tapped winding and, in most cases, a magnetic core to concentrate magnetic flux. An alternating current in one winding creates a time-varying magnetic flux in the core, which induces a voltage in the other windings. Transformers are used to convert between high and low voltages, to change impedance, and to provide electrical isolation between circuits.

The transformer is one of the simplest of electrical devices. Its basic design, materials, and principles have changed little over the last one hundred years, yet transformer designs and materials continue to be improved. Transformers are essential for high voltage power transmission, providing an economical means of transmitting power over large distances.

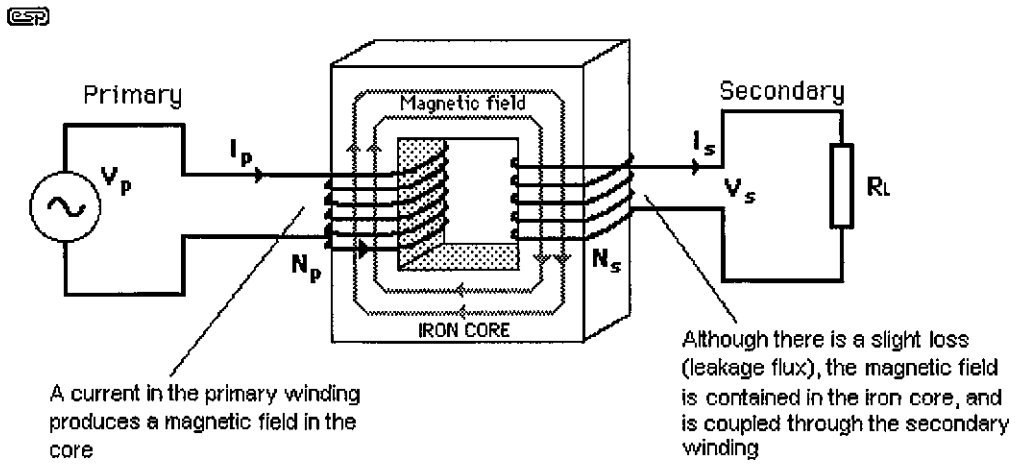

Figure 11: Basic Transformer

Figure shows the basics of all transformers. A coil (the primary) is connected to an AC voltage source - typically the mains for power transformers. The flux induced into the core is coupled through to the secondary, a voltage is induced into the winding, and a current is produced through the load.

The diagram also shows the various parts of a transformer. This is a simple transformer, with two windings. The primary (denoted as such during the design) will induce a magnetic field into the core in sympathy with the current produced by the applied AC voltage. The magnetic field is concentrated by the core, and nearly all of it will pass through the windings of the secondary as well, where a voltage is induced. The core in this case is typical of the construction of a "C-Core" transformer, where the primary and secondary are separated. More common is the "traditional" EI (ee-eye) type, which although somewhat out of favor these days is still used extensively.
Principle of transformers is Mutual Inductance- A changing electromagnetic field produced by the current in one coil will cause an induced voltage in the second coil because of mutual inductance.

Types of Transformers

- Power Transformers- Power transformers are used to convert from one voltage to another, at significant power levels.
- Step-up transformers- A "step-up transformer" allows a device that requires a high voltage power supply to operate from a lower voltage source. The transformer takes in the low voltage at a high current and puts out the high voltage at a low current. It has more turns in the secondary than in the primary. The voltage induced in the secondary will be more than applied to the primary.
- Step-down transformers- A "step-down transformer" allows a device that requires a low voltage power supply to operate from a higher voltage. The transformer takes in the high voltage at a low current and puts out a low voltage at a high current. There are more turns in the primary than in the secondary. The voltage induced in the secondary will be less than the voltage applied to the primary.

- Isolation transformers- An "isolation transformer" does not raise or lower a voltage; whatever voltage comes in is what goes out. An isolation transformer prevents current from flowing directly from one side to the other. This usually serves as a safety device to prevent electrocution.
- Variable auto-transformers- A "variable auto-transformer" (variac) can act like a step-up transformer or step-down transformer. It has a big knob on top that allows you to dial in whatever output voltage you want.

Safety

Safety is a major consideration for any power transformer (and in the case of telecommunications, the isolating transformers), and electrical contact between primary and secondary must not be allowed under any realistic fault condition.

Many power transformers are fitted with an internal "once only" thermal fuse that will become open circuit in the event that a preset temperature is exceeded. This temperature is chosen to be the maximum safe temperature of the windings before the insulation melts or breaks down, so in the event of a fault, the thermal fuse will open before the insulation is damaged and the component becomes potentially dangerous. Once the thermal fuse opens, the transformer must be discarded, as it is usually not possible to gain access to the fuse for replacement. This is not as silly as it may sound, since the thermal effects on the insulation cannot be predicted, and the transformer may be unsafe if it were still able to be used open before the insulation is damaged and the component becomes potentially dangerous. It also helps to prevent the risk of fire.

Noise

Transformers make noise. This is not only the electrical noise that is created by the nasty current waveform through the windings, diodes and into the filter capacitors, but actual audible noise. One source is winding vibration, due to the wire moving because of the magnetic field and the current flowing through the conductors. This is to be avoided at all costs, since constant vibration will eventually wear away the insulation, the windings will short circuit, and the transformer is ruined. Fortunately, this is rather unusual, but it can (and does) happen on occasion.

Most of the noise is from the laminations or other core material, which contract when subjected to an intense magnetic field. This is called magnetostriction, and happens to a greater or lesser degree with all magnetic materials.

Losses

An ideal transformer would have no losses, and would therefore be 100% efficient. In practice energy is dissipated due both to the resistance of the windings (known as copper loss), and to magnetic effects primarily attributable to the core (known as iron loss). Transformers are in general highly efficient, and large power transformers (around 50 MVA and larger) may attain an efficiency as high as 99.75%. Small transformers such as a plug-in "power brick" used to power small consumer electronics may be less than 85% efficient.

The losses arise from:

- Winding resistance- Current flowing through the windings causes resistive heating of the conductors.
- Eddy currents- Induced currents circulate in the core and cause its resistive heating.
- Stray losses- Not all the magnetic field produced by the primary is intercepted by the secondary. A portion of the leakage flux may induce eddy currents within nearby conductive objects such as the transformer's support structure, and be converted to heat. The familiar hum or buzzing noise heard near transformers is a result of stray fields causing components of the tank to vibrate, and is also from magnetostriction vibration of the core.
- Hysteresis losses -Each time the magnetic field is reversed, a small amount of energy is lost to hysteresis in the magnetic core. The level of hysteresis is affected by the core material.

- Mechanical losses- The alternating magnetic field causes fluctuating electromagnetic forces between the coils of wire, the core and any nearby metalwork, causing vibrations and noise which consume power.
- Magnetostriction- The flux in the core causes it to physically expand and contract slightly with the alternating magnetic field, an effect known as magnetostriction. This in turn causes losses due to frictional heating in susceptible ferromagnetic cores.
- Cooling system- Large power transformers may be equipped with cooling fans, oil pumps or water-cooled heat exchangers designed to remove the heat caused by copper and iron losses. The power used to operate the cooling system is typically considered part of the losses of the transformer.

Uses of Transformer

- For supplying power from an alternating current power grid to equipment which uses a different voltage. May be followed by a rectification circuit, if direct rather than alternating power is needed.
- Adaptation of electrical equipment to supply voltages for which it was not made. For example, to use U.S. equipment, designed for 117 V AC, in European countries with 230 V AC. A transformer or autotransformer may be used , or electronic voltage changers which do not use transformers.
- Use inside solid-state equipment which requires low voltages to reduce the main electricity voltage to the required value.
- Use as an external adapter to power low-voltage solid-state equipment from higher-voltage main electricity.
- Electric power transmission over long distances.
- High-voltage direct-current HVDC power transmission systems
- Large, specially constructed power transformers are used for electric arc furnaces used in steelmaking.
- Rotating transformers are designed so that one winding turns while the other remains stationary. A common use was the video head system as used in VHS and

Beta video tape players. These can pass power or radio signals from a stationary mounting to a rotating mechanism, or radar antenna.

- Sliding transformers can pass power or signals from a stationary mounting to a moving part such as a machine tool head. See linear variable differential transformer.
- Some rotary transformers are precisely constructed in order to measure distances or angles. Usually they have a single primary and two or more secondary, and electronic circuits measure the different amplitudes of the currents in the secondary.
- Small transformers are often used internally to isolate and link different parts of radio receivers and audio amplifiers, converting high current low voltage circuits to low current high voltage, or vice versa. See electronics and impedance matching. See also isolation transformer and repeating coil.
- Transformers may be used as external accessories for impedance matching; for example to match a microphone to an amplifier. These were frequently required with valve equipment, but solid-state electronics are more capable of matching a wide range of impedances without the need for a transformer.
- Balanced-to-unbalanced conversion. A special type of transformer called a balun is used in radio and audio circuits to convert between balanced circuits and unbalanced transmission lines such as antenna downleads. A balanced line is one in which the two conductors (signal and return) have the same impedance to ground: twisted pair and "balanced twin" are examples. Unbalanced lines include coaxial cables and strip-line traces on printed circuit boards. A similar use is for connecting the "single ended" input stages of an amplifier to the high-powered "push-pull" output stage.

BC547 Transistor

These are NPN silicon planar epitaxial transistors for use in AF small amplifier stages and direct coupled circuits.

Voltage rating: 50V

Maximum current: 0.1A

Power rating: 0.5W

Frequency range: 300 MHz

Crystal Oscillator

A crystal oscillator (sometimes abbreviated to XTAL on schematic diagrams) is an electronic circuit that uses the mechanical resonance of a physical crystal of piezoelectric material along with an amplifier and feedback to create an electrical signal with a very precise frequency. It is an especially accurate form of an electronic oscillator. This frequency is used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters. Crystal oscillators are a common source of time and frequency signals. The crystal used therein is sometimes called a "timing crystal".

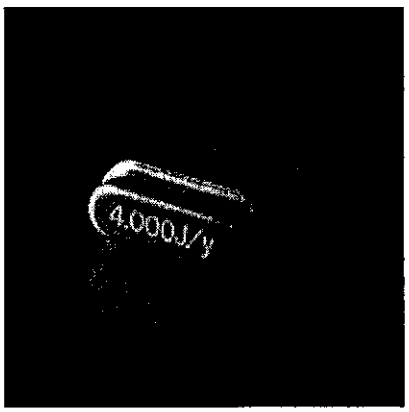

Figure 12: A miniature Quartz timing crystal

Environmental changes of temperature, humidity, pressure, and vibration can change the resonant frequency of a quartz crystal, but there are several designs that reduce these environmental effects. These include the TCXO, MCXO, and OCXO. These designs (particularly the OCXO) often produce devices with excellent short-term stability. The limitations in short-term stability are due mainly to noise from electronic components in the oscillator circuits. Long term stability is limited by aging of the crystal. Due to aging and environmental factors such as temperature and vibration, it is hard to keep even the best quartz oscillators within one part in 10(power-10) of their nominal frequency without constant adjustment.

CONCLUSION

The circuit performed as expected. When we transmitted data one with the help of the serial port the Infrared transmitted the data when TSOP was aligned in line of sight of the Infrared led it received the correct data there at the receiver. We have also verified it with the Digital Multi-meter(DMM) which showed us the change in voltage variations at various levels of the circuit. The pulse seen on the multi-meter varied from 0 to 5V where 5V signifies higher logic and 0 signifies lower level logic. Similarly, the data was received correctly for data 2 and 3.

TRANSMITTED DATA	RECEIVED DATA
01	01
02	02
03	03

LIMITATIONS

Infrared communications span very short distances. Place two infrared devices within a few of each other when networking them. Unlike Wi-Fi and Bluetooth technologies, infrared network signals cannot penetrate walls or other obstructions and work only in the direct "line of sight."

Problems with IR

IR is a fairly cheap and easy way for two things to communicate. However, it does have a number of problems, including:

- The Sun- The sun gives off a lot of infrared light. In direct sunlight, the IR receiver can be "flooded" and won't be able to see any incoming messages. To work around this, always use your Mindstorms indoors and out of direct sunlight.

- Line-of-sight. We need to point a TV remote control directly at the TV for it to work. If we point the remote in some other direction, or if we put your hand between the remote and the TV, chances are the remote will stop working. Similarly we need to have line of sight communication between our transmitter and the receiver.