WIRELESS TEXT TRANSMISSION WITH ENCRYPTION FACILITY

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CERTIFICATE

This is to certify that the work entitled, "WIRELESS TEXT TRANSMISSION WITH ENCRYPTION FACILITY" submitted by GAURAV SINGH, NALAM SANDEEP, and JITENDER KUMAR in partial fulfillment for the award of degree of Bachelors 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.

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ACKNOWLEDGMENT

In any project the presence of a mentor is an indispensable requirement. In our project also not only did our guide give us all the conceptual and practical support but also motivated us to do our best. It was because of his belief and dedication that we were able to complete this project successfully. For all this support and guidance we sincerely wish to thank our guide, Dr. D.S Saini.

Also, we wish to thank other people who directly or indirectly helped us in completion of this project and whose names have been inadvertently missed out by us in this acknowledgement.

- GAURAV SINGH
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ABSTRACT

In information based society communication of knowledge is of paramount importance. Although knowledge can be expressed in various forms textual representation is amongst the oldest and the most common methods. So in this modern age of microcontrollers, special function ICs and numerous communication systems we decided to come up with a wireless text transmission system. Our design enables us to send textual data of any kind over a high range between a transmitter station and a receiver station. The communication is done using infrared technology and microcontrollers are used to handle the logistics of the entire operation. LCDs have been used to provide a visual interface and push button keys have been used for the keypad. For security and encryption purposes DIP switches are used for addressing and a 3 digit password facility is also provided.

CHAPTER 1: INTRODUCTION

In this chapter we have expressed our aim of the project and also have given an overview of the features and applications. We have also mentioned the limitations of the project and given a bird eye view of the future developments.

1.1 Aim of the Project

The aim of the project was to build a device which was capable of sending text data via infra-red. Since these days text transmission is a very common need we aimed at building a cheap yet effective device which could fulfill this purpose. The use of infra-red communication was preferred over others keeping in mind the cost factor.

1.2 Features of the Project

The project consists of two independent circuits (Transmitter and Receiver) which communicate with each other wirelessly. The features can be elaborated as:

1.2.1 Transmitter

The salient features of the transmitter are :

(a) A microcontroller is used to serve as the brain of the system. It takes the input data, analyses and decodes it, encrypts it and then sends it via the infra-red circuitry.

(b) Push button switches are used to serve as a keypad.

(c) A regulator is used to provide the required power to the microcontroller.

(d) A LCD is connected to the microcontroller to give a visual display to the data being written and the data being sent.

(e) A DIP switch is added to provide address for the receiver. This helps to serve as an additional security feature.

1.2.2 Receiver

The salient features of the receiver are:

(a) It also has a microcontroller which serves as the brain. Along with the above mentioned functions it also performs additional functions of address decoding and address checking, password checking and decryption.

(b) The push button switches serve as keypad for entering the password.

(c) A regulator, LCD and DIP switch do similar functions as in transmitter.

1.3 Block Diagram

The block diagram of the entire system is as shown below. The transmitter and receiver block diagrams are shown together and the dotted connection represents the wireless IR connection.

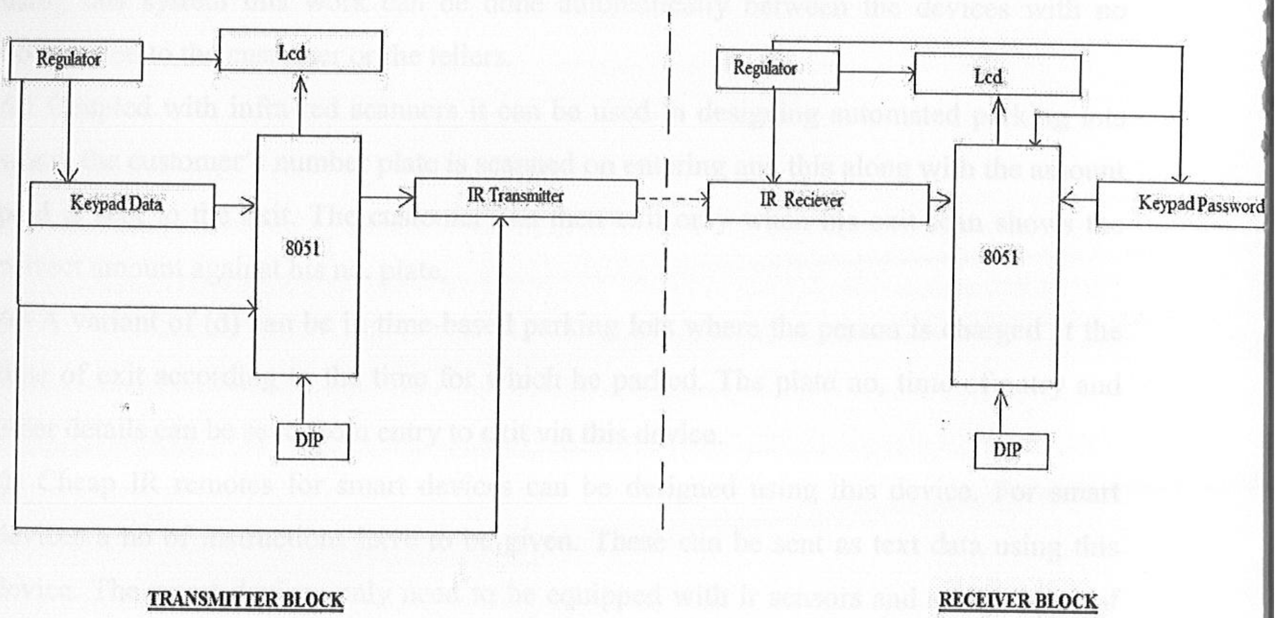


FIGURE 1.1: Block diagram

1.4 Applications of the Project

The project in its current form has numerous applications which are outlined below:

(a) It can be used as a device for text transmission in an office. Offices usually have needs for transmission of textual data. Simply by orienting their devices in the line of sight region the workers can transfer their data quickly, effectively and freely. This entails a lot of savings in terms of man-hours and also money spent on networking needs

(b) It can be an effective teaching aid in classrooms with the teacher transmitting notes via the transmitter and students taking notes via the receiver. Thus both the student and teacher can concentrate more on their personal interaction and we can have a more holistic learning atmosphere.

(c) It can be a useful device to have in shopping complexes and malls. Since in these places the area where the item is procured and where it is paid for are different the customer is required to take the details of his purchase from one area to the other. By using this system this work can be done automatically between the devices with no botheration to the customer or the tellers.

(d) Coupled with infra-red scanners it can be used in designing automated parking lots where the customer's number plate is scanned on entering and this along with the amount paid is sent to the exit. The customer can then exit only when his exit-scan shows the correct amount against his no. plate.

(e) A variant of (d) can be in time-based parking lots where the person is charged at the time of exit according to the time for which he parked. The plate no, time of entry and other details can be send from entry to exit via this device.

(f) Cheap IR remotes for smart devices can be designed using this device. For smart devices a no of instructions have to be given. These can be sent as text data using this device. The smart devices only need to be equipped with ir sensors and a high level of mobility in operation can be achieved.

(g) The device can find a lot of commercial use in assembly line production where data needs to be continuously sent from one unit of production to the other. This transmission can become cheap and simple with the use of this device.

(h) The concept of information booths in airports, railway stations, booking counters, payment counters etc. is fast catching on. This device can find application there also. The device can be used separately or attached to some other device and the user can query the booth form a distance and get the information he wants with ease.

1.5 Limitations of the Project

Since infra-red technology has been used for the transmission of the data a limitation of the project is that transmission can occur only when the receiver and the transmitter are in line of sight. This makes positioning and removal of obstacles very important criterion.

Another limitation of the project is that the range is not very large. Because the infra-red technology has a much shorter range as compared to other similar technologies therefore the scope of the project is limited. With the equipments that we have used we found the range to be approx. 80 inches.

But despite these limitations the project has a lot of potential as has been demonstrated in the applications.

1.6 Future Works

This project can be taken to the next level in a no. of directions. We can either modify the IR system used or use a different system. The future modifications can be as :

(a) The infrared LED and Diode can be replaced by devices which have a much wider area which will make line of sight communication a lot more easier.

(b) Also IR devices with more ranges can be used which will extend the range of the system.

(c) Also apart from IR other technologies can be used. Like the infra red technology can be replaced with Bluetooth technology or we can also use data cables.

CHAPTER 2: OVERVIEW OF AN EMBEDDED SYSTEM

In this chapter we have mentioned the basics of an embedded system. An embedded system has been compared with a computer system and along with the comparative advantages the applications have been mentioned. The given discussion will make it clear why we choose an embedded system and also make our reasons behind choosing a microcontroller clear.

2.1 What is an Embedded System?

An Embedded system with its basic features has been described below:

(a) An embedded system is a combination of computer hardware and software, and Perhaps additional mechanical or other parts, designed to perform a specific function. A good example is the microwave oven. Almost every household has one, and tens of millions of them are used every day, but very few people realize that a processor and software are involved in the preparation of their lunch or dinner.

(b) Electronic devices that incorporate a computer (usually a microprocessor) within their implementation.

(c) A computer is used in such devices primarily as a means to simplify the system design and to provide flexibility.

(d) Is a system built to perform its duty, completely or partially independent of human intervention.

(e) Is specially designed to perform a few tasks in the most efficient way.

(f) Interacts with physical elements in our environment, viz. controlling and driving a motor, sensing temperature, etc.

2.2 What is the difference between a Computer System and an Embedded System?

(a) Computer system has general purpose microprocessor with no onchip RAM, ROM, I/O ports .so in computer system we have to add external RAM, ROM, I/O ports to make them functional .But in case of embedded system all the components are available on same chip.

*(b)*An embedded computer is frequently a computer that is implemented for a particular purpose .In contrast, an average PC computer usually serves a number of purposes: checking email, surfing the internet, listening to music, word processing, etc.. However, embedded systems usually only have a single task, or a very small number of related tasks that they area related programmed to perform.

2.3 Applications of an Embedded System

Some of the common applications are:

(a) Aerospace: Navigation systems, automatic landing systems, flight attitude controls, engine controls, space exploration (e.g., the Mars Pathfinder).

(b) Automotive: Fuel injection control, passenger environmental controls, anti-lock braking systems, air bag controls, GPS mapping.

(c) Computer Peripherals: Printers, scanners, keyboards, displays, modems, hard disk drives, CD-ROM drives.

(d) Home: Dishwashers, microwave ovens, VCRs, televisions, stereos, fire/security alarm systems, lawn sprinkler controls, thermostats, cameras, clock radios, answering machines.

(e) Industrial: Elevator controls, surveillance systems, robots

(f) Office Automation: FAX machines, copiers, telephones, cash registers.

(g) Personal: Personal Digital Assistants (PDAs), pagers, cell phones, wrist watches, video games, portable MP3 players, GPS.

2.4 Advantages of an Embedded System

Although an embedded system is theoretically and practically different from a computer system in many cases it finds itself in competition with it. In many of these cases a microcontroller is preferred over a microprocessor system because of the numerous inherent advantages it provides. Some of these advantages have been described below:

(a) If an embedded system is designed well, the existence of the processor and software could be completely unnoticed by a user of the device. Such is the case for a microwave oven, VCR, or alarm clock.

(b) It is much easier, and cheaper, to change a few lines of software in embedded system than to redesign a piece of custom hardware.

(c) Embedded system can replace big integrated circuit that performs the same functions as hardware.

(d) In embedded system all the components are available on single chip which reduces the size of the product.

(e) Both in design and production an embedded system is much cheaper as compared to its competitors.

CHAPTER 3: HARDWARE SPECIFICATIONS

In this chapter we have given an overview of the various components used by us. A brief theoretical description of all the components along with their functions and working is given. Along with that the circuit of the component as used in our project is given.

3.1 Components used

TABLE 3.1: Component List

PART NAME	QUANTTITY	TRANSMITTER	RECIEVER
AT89S51	2	Yes	Yes
CD17805	2	Yes	Yes
Capacitor (100µF)	2	Yes	Yes
4K7 Variable Resistance	2	Yes	Yes
558 npn Transistor	2	Yes	Yes
548 pnp Transistor	1	Yes	No
547 pnp Transistor	1	No	Yes
Dip (4switch)	2	Yes	Yes
Didode 1N4007	2	Yes	Yes
12 Mhz Crystal	2	Yes	Yes
UA741	1	Yes	No
Paper Capacitor(27 pf)	4	Yes	Yes
10µF Capacitor	2	Yes	Yes
4.7µF Capacitor	1	No	Yes

Variable Resistance	1	Yes	No
Infrared LED	1	Yes	No
TSOP1738	1	No	Yes
10KΩ Resistor Bank	2	Yes	Yes
Switches	20	Yes	Yes
LCD(2*16)	2	Yes	Yes
L.E.D.(red)	2	Yes	Yes
Buzzer(27C608)	1	No	Yes
Printed Circuit Boards	2	Yes	Yes

3.2 Microcontroller

3.2.1 What is the primary difference between a microprocessor and a micro controller?

Unlike the microprocessor, the micro controller can be considered to be a true "Computer on a chip". In addition to the various features like the ALU, PC, SP and registers found on a microprocessor, the micro controller also incorporates features like the ROM, RAM, Ports, timers, clock circuits, counters, reset functions etc. While the microprocessor is more a general-purpose device, used for read, write and calculations on data, the micro controller, in addition to the above functions also controls the environment.

3.2.2 AT89S51

In this project we are using AT89S51. The device is manufactured by Atmel's and is compatible with the industry standard 80C51 instruction set and pinout. Its salient points are :

(a) Features

- Compatible with MCS®-51 Products
- 4K Bytes of In-System Programmable (ISP) Flash Memory

- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 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
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode
- Watchdog Timer
- Dual Data Pointer
- Power-off Flag
- Fast Programming Time
- Flexible ISP Programming (Byte and Page Mode)

(b) Pin Configurations

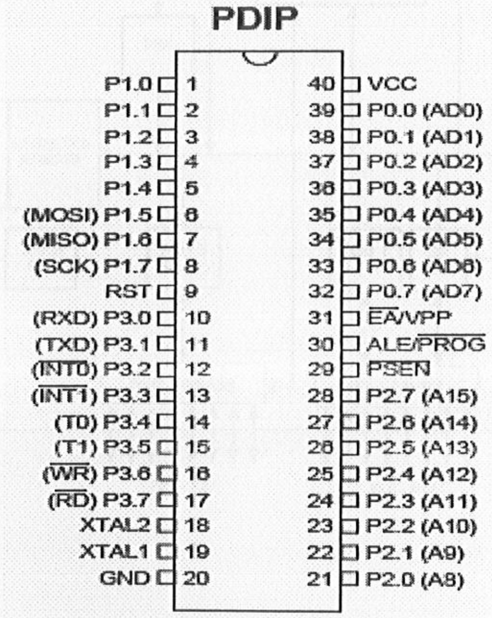


FIGURE 3.1: Pin diagram of AT89S51

(c) Block diagram

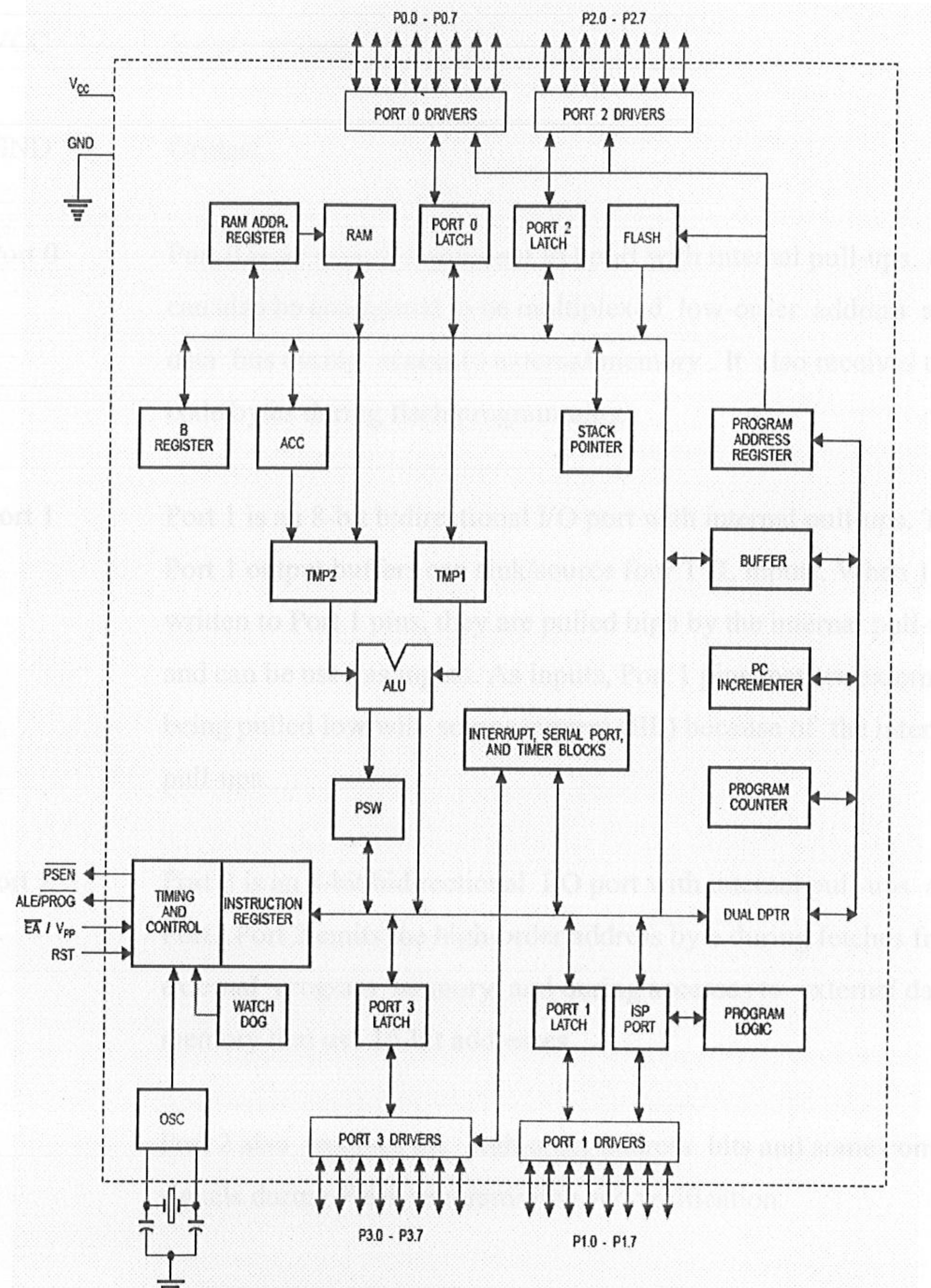


FIGURE 3.2: Block Diagram of AT89S51

(d) Pin Description

VCC	Supply voltage.
GND	Ground.
Port 0	Port 0 is an 8-bit bidirectional I/O port with internal pull-ups. Port0 can also be configured to be multiplexed low-order address and data bus during access to external memory . It also receives the code bytes during flash programming.
Port 1	Port 1 is an 8-bit bidirectional I/O port with internal pull-ups. 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 source current (IIL) because of the internal pull-ups.
Port 2	Port 2 is an 8-bit bidirectional I/O port with internal pull-ups as Port1.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. 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 pull-ups as Port2.Port 3 receives some control signals for Flash programming and verification.

Port 3 also serves the functions of various special features of the AT89S51, as shown in the following table.

TABLE 3.2: Alternative Functions of P3

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 (ALE) is an output pulse for latching the low byte of the address during accesses to external memory .This pin is also the program pulse input during Flash programming.

PSEN Program Store Enable (PSEN) is the read strobe to external program memory. When the AT89S51 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each 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.

XTAL1 Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2 Output from the inverting oscillator amplifier.

(e) Memory Organization

MCS-51 devices have a separate address space for Program and Data Memory. Up to 64K bytes each of external Program and Data Memory can be addressed.

- *Program Memory*: If the EA pin is connected to GND, all program fetches are directed to external memory. On the AT89S51, if EA is connected to VCC, program fetches to addresses 0000H through FFFH are directed to internal memory and fetches to addresses 1000H through FFFFH are directed to external memory.

- *Data Memory*: The AT89S51 implements 128 bytes of on-chip RAM. The 128 bytes are accessible via direct and indirect addressing modes. Stack operations are examples of indirect addressing, so the 128 bytes of data RAM are available as stack space.

(f) SFRs (Special Function Registers)

A map of the on-chip memory area called the Special Function Register (SFR). SFRs are a kind of control table used for running and monitoring microcontroller's operating. Each of these registers, even each bit they include, has its name, address in the scope of RAM and clearly defined purpose (for example: timer control, interrupt, serial connection etc.).

TABLE 3.3: SFR registers along with their reference memory address

0F8H									0FFH
0F0H	B 00000000								0F7H
0E8H									0EFH
0E0H	ACC 00000000								0E7H
0D8H									0DFH
0D0H	PSW 00000000								0D7H
0C8H									0CFH
0C0H									0C7H
0B8H	IP XX000000								0BFH
0B0H	P3 11111111								0B7H
0A8H	IE 0X000000								0AFH
0A0H	P2 11111111		AUXR1 XXXXXXX0				WDTRST XXXXXXXX		0A7H
98H	SCON 00000000	SBUF XXXXXXXX							9FH
90H	P1 11111111								97H
88H	TCON 00000000	TMOD 00000000	TL0 00000000	TL1 00000000	TH0 00000000	TH1 00000000	AUXR XXX00XX0		8FH
80H	P0 11111111	SP 00000111	DP0L 00000000	DP0H 00000000	DP1L 00000000	DP1H 00000000		PCON 0XXX0000	87H

3.2.3 Microcontroller circuit as used in our project

(a) Transmitter circuit

The circuit shows how the various pins of microcontroller are connected to different components in the transmitter circuit.P0 port (P0.0-P0.7) is connected to the data pins of LCD (LCD7-LCD14) .DIP switch is connected to pin P2.0-P2.3.keypad switches (S1-S8) are connected across P1(P1.0-P1.7).Crystal is attached between 19

& 18 pin of microcontroller . Serial data pin 11(P3.1) of microcontroller is attached to IR circuit for data transmission through infrared led.pin 40 of microcontroller is connected to 5v, output of regulator circuit. Pin 9 (RST) of microcontroller is connected to reset circuit through which we can reset the circuit by pressing reset switch. Keypad is connected to p1 & p3.

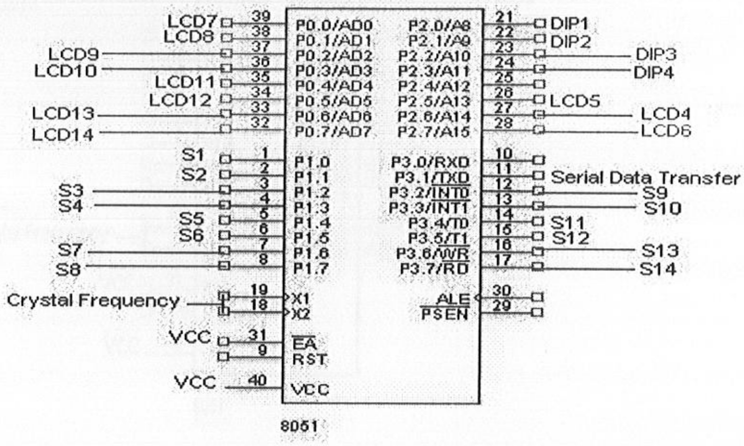


FIGURE 3.3: Pin Connections of microcontroller (Trans)

(b) Receiver circuit

The circuit shows how the various pins of microcontroller are connected to different components in the transmitter circuit. P0 port (P0.0-P0.7) is connected to the data pins of LCD (LCD7-LCD14). DIP switch is connected to pin P2.0-P2.3. Keypad switches (S1-S4) are connected across P3. Crystal is attached between 19 & 18 pin of microcontroller. Receiver circuit is connected to P3.0 (RXD) to receive the serial data sent by transmitter. P3.4-P3.7 are connected to the switches to enter the password for data security from unauthorized persons. The port P1 in the receiver circuit is left empty

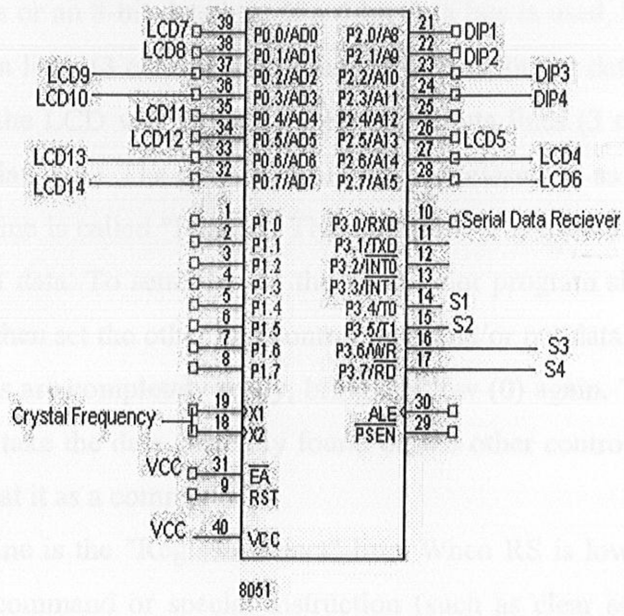


FIGURE 3.4: Pin Connections of microcontroller (Recv)

3.3 LCD

Frequently, an 8051 program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to an 8051 is an LCD display. Some of the most common LCDs connected to the 8051 are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively. Fortunately, a very popular standard exists which allows us to communicate with the vast majority of LCDs regardless of their manufacturer. The standard is referred to as HD44780U, which refers to the controller chip which receives data from an external source (in this case, the 8051) and communicates directly with the LCD.

3.3.1 '44780' Background

The 44780 standard requires 3 control lines as well as either 4 or 8 I/O lines for the data bus. The user may select whether the LCD is to operate with a 4-bit data bus or an 8-bit data bus. If a 4-bit data bus is used, the LCD will require a total of 7 data lines (3 control lines plus the 4 lines for the data bus). If an 8-bit data bus is used, the LCD will require a total of 11 data lines (3 control lines plus the 8 lines for the data bus). The three control lines are referred to as EN, RS, and RW.

The ***EN*** line is called "Enable." This control line is used to tell the LCD that you are sending it data. To send data to the LCD, your program should first set this line high (1) and then set the other two control lines and/or put data on the data bus. When the other lines are completely ready, bring EN low (0) again. The 1-0 transition tells the 44780 to take the data currently found on the other control lines and on the data bus and to treat it as a command.

The ***RS*** line is the "Register Select" line. When RS is low (0), the data is to be treated as a command or special instruction (such as clear screen, position cursor, etc.). When RS is high (1), the data being sent is text data which should be displayed on the screen. For example, to display the letter "T" on the screen you would set RS high.

The ***RW*** line is the "Read/Write" control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction ("Get LCD status") is a read command. All others are write commands--so RW will almost always be low

The HD44780 or compatible controller is basically designed to build LCD displays with one or two lines with a maximum of 40 character positions each. A single HD44780 is able to display two lines of 8 characters each. If we want more, the HD44780 has to be expanded with one or more expansion chips, like the HD 44100 (2 x 8 characters expansion) or the HD 66100 (2 x 16 characters expansion).

3.3.2 Pin Description

The pins of the LCD and their functions along with the relevant connections are given in table 3.4.

TABLE 3.4: Pin description of LCD (2x16)

Pin	Symbol	I/O	Description
1	GND	-	Ground
2	Vcc	-	+5V power supply
3	VEE	-	Contrast control
4	RS	I	command/data register selection
5	R/W	I	write/read selection
6	E	I/O	Enable
7	DB0	I/O	The 8-bit data bus
8	DB1	I/O	The 8-bit data bus
9	DB2	I/O	The 8-bit data bus
10	DB3	I/O	The 8-bit data bus
11	DB4	I/O	The 8-bit data bus
12	DB5	I/O	The 8-bit data bus
13	DB6	I/O	The 8-bit data bus
14	DB7	I/O	The 8-bit data bus

The first two pins are for the Vcc and GND for the LCD. Third is for the contrast control and is connected to output of variable resistance. The next three pins are for control and selection operations as explained earlier. The next 8 are data pins and the last two are for backlight control.

3.3.3 LCD commands

The LCD has its own set of commands, as dictated by HD44780. All the operations that it does are according to this command set which are given in the next table :

TABLE 3.5 : LCD commands

Instruction	Decimal	HEX
Function set (8-bit interface, 2 lines, 5*7 Pixels)	56	38
Function set (8-bit interface, 1 line, 5*7 Pixels)	48	30
Function set (4-bit interface, 2 lines, 5*7 Pixels)	40	28
Function set (4-bit interface, 1 line, 5*7 Pixels)	32	20
Entry mode set	See Below	See Below
Scroll display one character right (all lines)	28	1E
Scroll display one character left (all lines)	24	18
Home (move cursor to top/left character position)	2	2
Move cursor one character left	16	10
Move cursor one character right	20	14
Turn on visible underline cursor	14	0E
Turn on visible blinking-block cursor	15	0F
Make cursor invisible	12	0C
Blank the display (without clearing)	8	08
Restore the display (with cursor hidden)	12	0C
Clear Screen	1	01
Set cursor position (DDRAM address)	128 + addr	80+ addr
Set pointer in character-generator RAM (CG RAM address)	64 + addr	40+ addr

Above table shows the various commands through which we can control the functioning of LCD. The commands are shown in both HEX and decimal. These commands instruct the internal controller to perform the required operation.

3.3.4 LCD circuit as used in our project

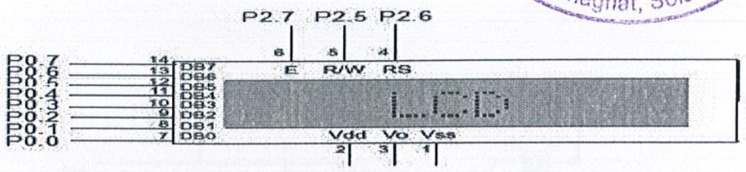


FIGURE 3.5: LCD Circuit

The LCD is connected in similar way in transmitter and receiver circuit. As shown in figure the pin 7-14 of LCD are connected to p0.E, R/W, RS are connected to p2.7, p2.5, p2.6 respectively. Pin 1 of LCD is connected to ground .pin 3 is connected to vcc through variable resistance to control brightness .pin 15 is connected to vcc trough diode to give protection to LCD.

3.4 TSOP1738

The TSOP17 series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are assembled on lead frame, the epoxy package is designed as IR filter. The demodulated output signal can directly be decoded by a microprocessor. TSOP17... Is the standard IR remote control receiver series, supporting all major transmission codes.

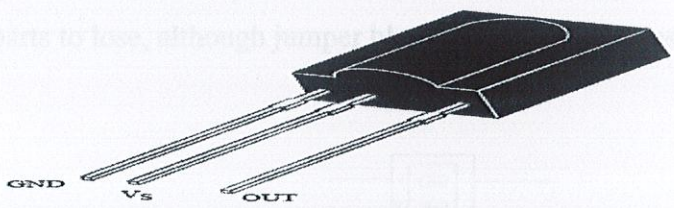


FIGURE 3.6: TSOP1738 (IR Receiver)

3.4.1 IR receiver circuit as used in our project

TSOP1738 is used in our project as IR receiver as shown in figure. Buzzer is used to indicate that data has been received by receiver.P3.0 that is serial data receive pin of microcontroller is connected to IR receiver circuit which sends the data received to microcontroller.

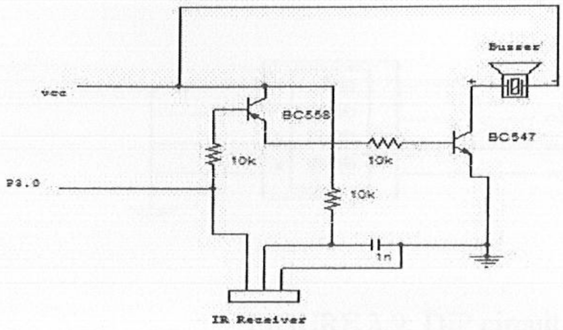


FIGURE 3.7: IR receiver Circuit

3.5 DIP

A DIP switch is a manual electric switch that is packaged in a group in a standard dual in-line package (DIP) (the whole package unit may also be referred to as a DIP switch in the singular). This type of switch is designed to be used on a printed circuit board along with other electronic components and is commonly used to customize the behavior of an electronic device for specific situations. DIP switches are an alternative to jumper blocks. Their main advantages being that they are quicker to change and there are no parts to lose, although jumper blocks are more often used due to lower cost.

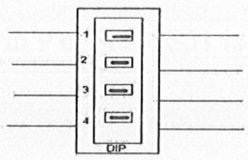


FIGURE 3.8: DIP switch

3.5.1 DIP switch as used in our project

The DIP switch is used to provide the security code to text data. It is connected to P2 port of microcontroller on both transmitter and receiver side as shown in figure. It has four switches through which sixteen different codes can be set.

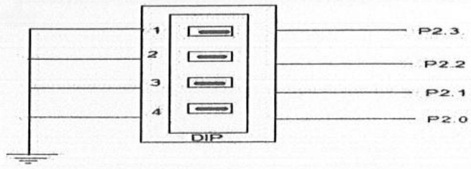


FIGURE 3.9: DIP circuit in project

3.6 Reset circuit

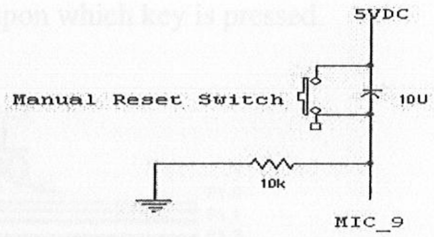


FIGURE 3.10: Reset circuit

Reset circuit is used to reset the microcontroller .In this circuit we used a switch to reset the microcontroller. Pin 9 of AT89S51 is connected to reset circuit as shown in figure.

3.7 IR Transmitter circuit

IR circuit transmits the data that is available on the serial data pin (P3.1) through infrared led. Different components used and connections in circuit are shown in the figure 3.11.

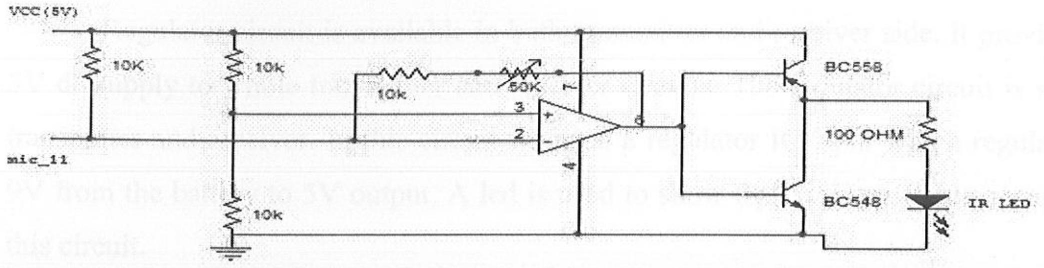


FIGURE 3.11: IR transmitter circuit

3.8 Keypad circuit

In this project we are using the keypad technology of mobile phones. Through each switch we can enter multiple characters. Switches are connected to microcontroller as shown in figure which scans these pins continuously and perform the required operation depending upon which key is pressed.

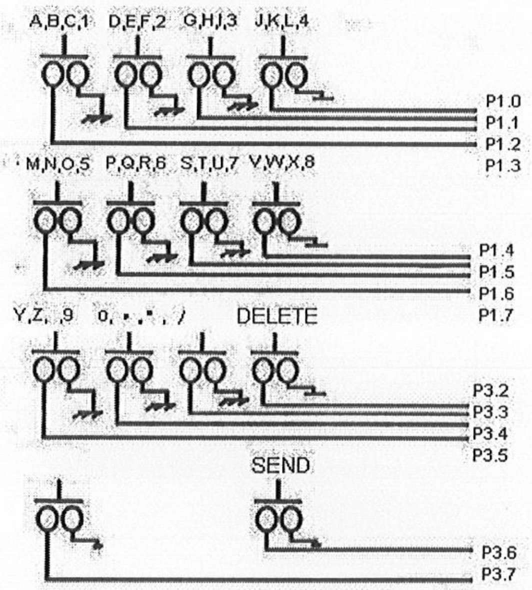


FIGURE 3.12: Keypad circuit

3.9 Regulator circuit

Regulator circuit is available in both transmitter and receiver side. It provides the 5V dc supply to whole transmitter and receiver circuits. The regulator circuit is same in transmitter and receiver. In this circuit we used a regulator IC 7805 which regulates the 9V from the battery to 5V output. A led is used to show that 5v is available at output of this circuit.

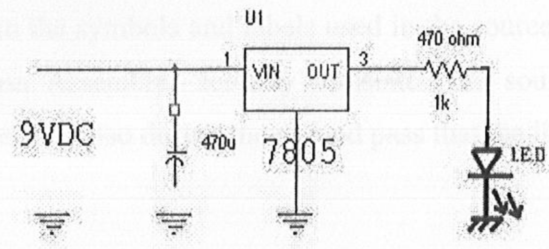


FIGURE 3.13: Regulator circuit

CHAPTER 4: APPLICATIONS USED

4.1 8051 Cross Assembler Overview

The 8051 Cross Assembler takes an assembly language source file created with a text editor and translates it into a machine language object file. This translation process is done in two passes over the source file. During the first pass, the Cross Assembler builds a symbol table from the symbols and labels used in the source file. It's during the second pass that the Cross Assembler actually translates the source file into the machine language object file. It is also during the second pass that the listing is generated.

4.2 PCB:

4.2.1 History of PCBs:

The PCB is now an essential part of Electronic Industry. PCBs are Dielectric Substrates with metallic circuitry formed on the surface. These are classified as single side, double side, Multilayer.

Single side having circuit only on one side, double side on both sides and may or may not have inter-connections between both sides, multilayer have more than two layers.

4.2.2 Use of PCBs:

- To interconnect the singular electronic components.
- To fix and hold the components
- To replace some passive components.

4.2.3 Flow chart for Single Side PCBs:

Blank cutting

↓

Drilling

↓

Deburring

↓

Photo-printing

↓

Dry film stripping

↓

Copper etching

↓

Masking

↓

HAL

↓

Legend printing

↓

Routing

↓

BBT

4.3 EEPROM Programmer

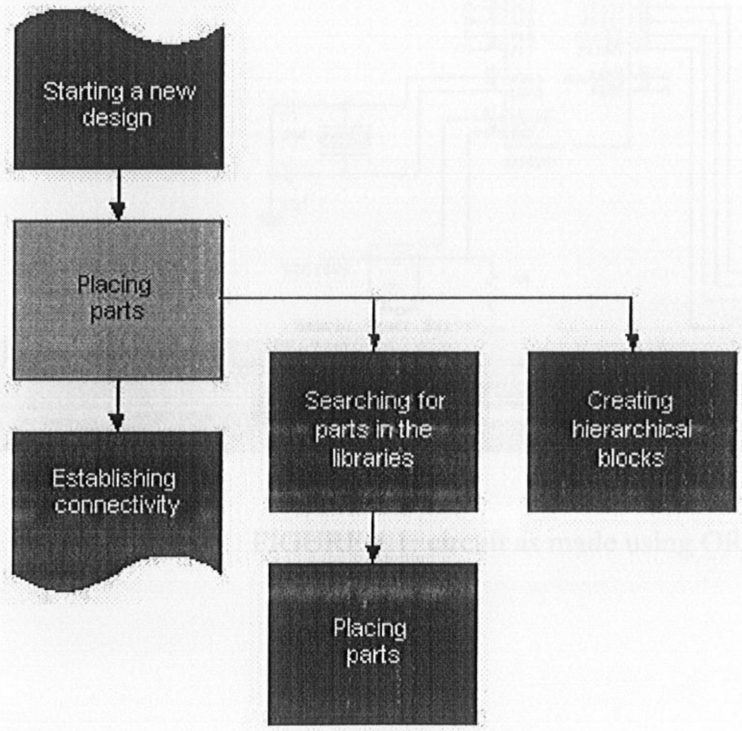
EEPROM programmer is used to burn the program into the flash memory of microcontroller. The burner requires the HEX code of the program to be burned into flash ROM. There are different kinds of burners available in the market with different specifications.

The programmer is connected to the computer through which we burn the required Rom using the supporting software available with programmer. We can only burn those devices that are supported by particular programmer. EEPROM programmer supports many devices for ex-EPROM, MICROCONTROLLER, FLASH MEMORY ETC

4.4 ORCAD

With the help of orcad we can make circuit diagrams and also simulate them in order to check their behavior and performance. In this project we used capture CIS software from orcad to make circuit diagrams. We created individual projects for different circuits.

4.4.1 Work flow for placing parts and pins in orcad:



Below picture shows the circuit as made using orcad:

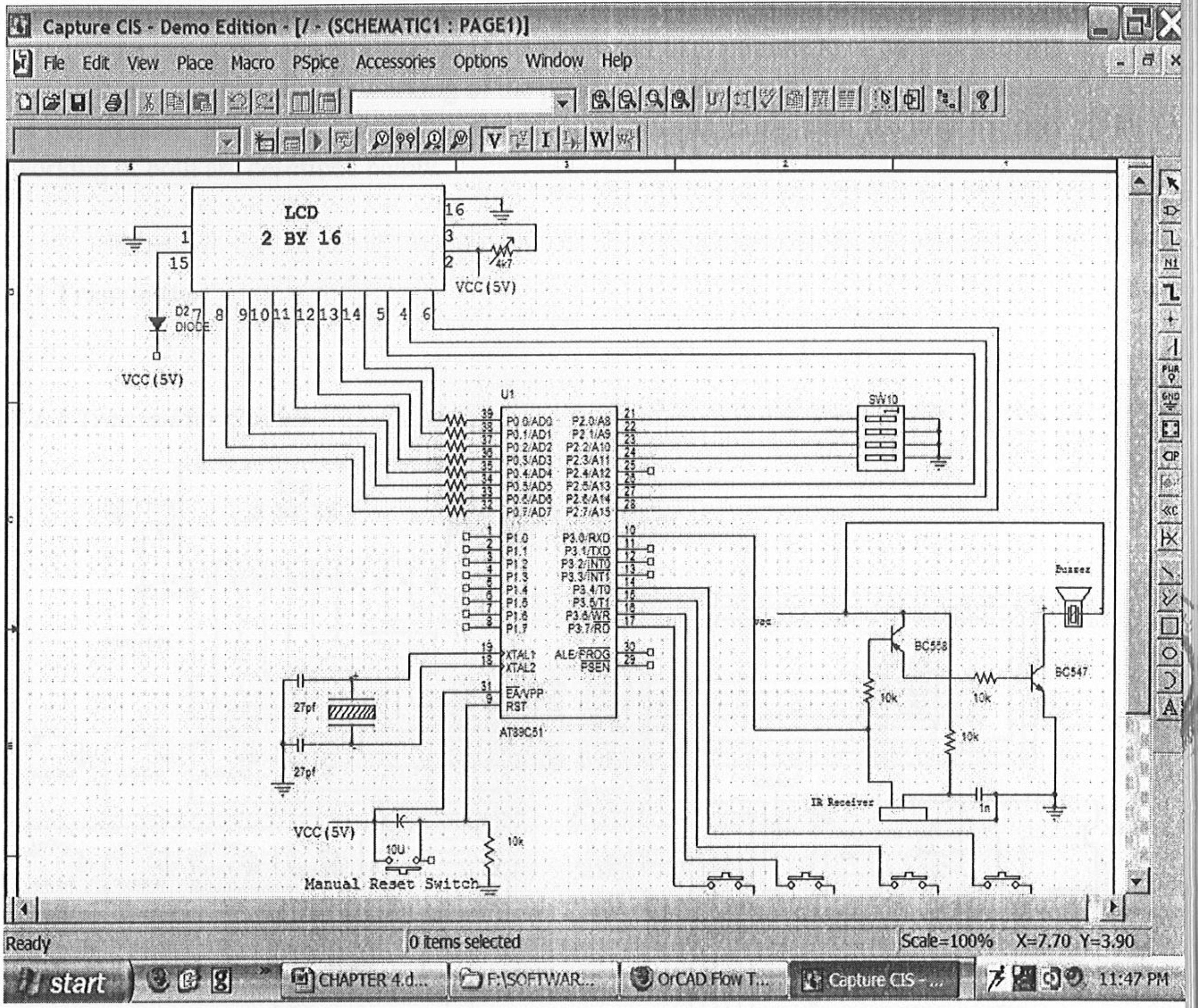


FIGURE 4.1: circuit as made using ORCAD

CHAPTER 5: WORKING OF THE PROJECT

The individual components, their functions and their circuits have been described earlier. Now, we describe the working of the project in entirety taking all the components as one system. The entire transmitter and receiver circuits along with the step by step working of both are described below.

5.1 Transmitter

5.1.1 Transmitter Circuit

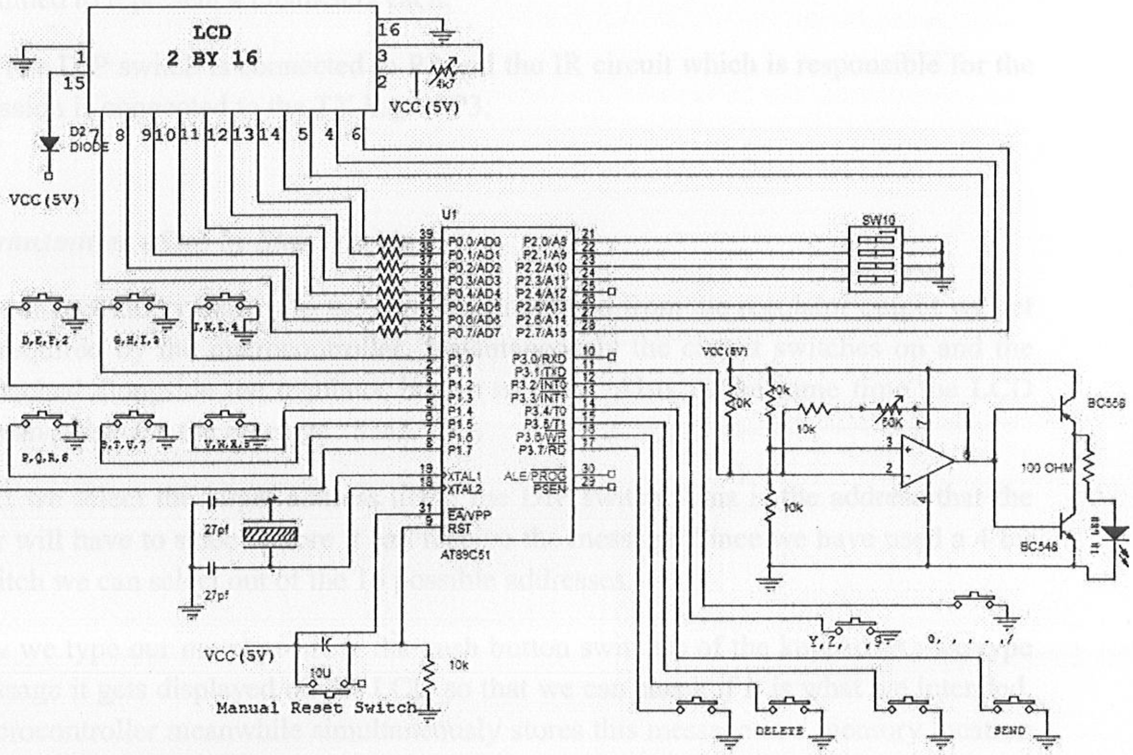


FIGURE 5.1: Complete transmitter circuit

The entire TRANSMITTER circuit is as shown above. The individual parts and their functions have been explained in the hardware chapter (CH3). The mapping and connections have also been explained in CH3. The entire circuit is just the different components of the system connected together. The inter-connections are shown clearly and from this circuit we get a clear picture of what the final system design is like and how it functions.

As can be seen from the final circuit the Microcontroller acts as the brain of the system with almost all other components connected to it. It monitors all of them according to the program code and also facilitates the interactions between them. The nature, timing, period, speed and efficiency of the communication are all primarily governed by the microcontroller.

The LCD acts as the visual interface of the system and shows us what we are writing and what we are sending. The data bits of the LCD are mapped to port 0. The rest of the bits are either mapped to Vcc /GND or the backlight/brightness mechanisms.

All the keys of the keypad are mapped to the ports of the microcontroller. Ports P1 and P3 are used for this purpose. The keys are push button types and they are programmed to represent 4 characters each.

The DIP switch is connected to P2 and the IR circuit which is responsible for the transmission is connected to the TX key of P3.

5.1.2 Transmitter - Step by Step Working

(a) We connect the 9v battery to the regulator input and from the regulator output we get the 5v required by the microcontroller. Instantaneously the circuit switches on and the LED attached alongside the regulator begins to glow. Also, at the same time the LCD turns on and displays the message "SMS TX".

(b) Next we select the target address using the DIP switch. This is the address that the receiver will have to select before it can receive the message. Since we have used a 4 bit DIP switch we can select out of the 16 possible addresses.

(c) Now we type our message using the push button switches of the keypad. As we type our message it gets displayed on the LCD so that we can check if it is what we intended. The microcontroller meanwhile simultaneously stores this message in a memory location from where it can later retrieve the message at the time of transmission.

(d) When we have finished typing the message we press the send key to transmit the message to the receiver. When we press the send key the microcontroller knows that this is the end of the data and now the data has to be sent to the receiver. It stops writing to the LCD and starts to retrieve the data stored in the memory location. It does so 8 bits at a time and sends this by putting the data in SBUF. SBUF automatically configures the data for transmission by adding starting and sending bits. The first 8 bits sent are the address got from the DIP switch. After that the data is sent in packets of 8 bits.

(e) After the entire data has been sent and received we must manually reset the microcontroller before beginning transmission again. For this we only need to press the reset switch provided with the manual reset circuitry. This will delete all the data stored by the microcontroller and we will reach the condition got at end of step (a).

5.2 Receiver

5.2.1 Receiver Circuit

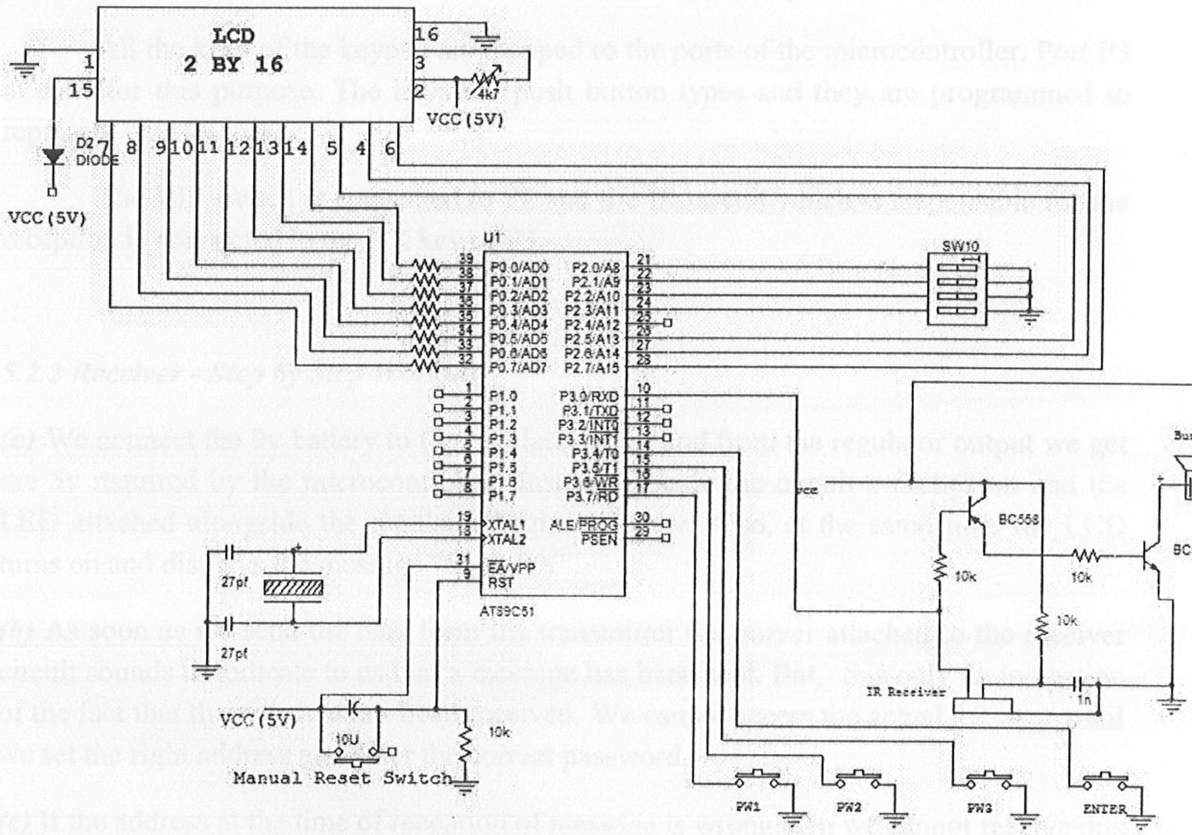


FIGURE 5.2: Complete receiver circuit

The entire RECEIVER circuit is as shown above. The individual parts and their functions have been explained in the hardware chapter (CH3). The mapping and connections have also been explained in CH3. The entire circuit is just the different components of the system connected together. The inter-connections are shown clearly and from this circuit we get a clear picture of what the final system design is like and how it functions.

As can be seen from the final circuit the Microcontroller acts as the brain of the system with almost all other components connected to it. It monitors all of them according to the program code and also facilitates the interactions between them. The nature, timing, period, speed and efficiency of the communication are all primarily governed by the microcontroller.

The LCD acts as the visual interface of the system and shows us what we are writing and what we are sending. The data bits of the LCD are mapped to port 0. The rest of the bits are either mapped to Vcc /GND or the backlight/brightness mechanisms.

All the keys of the keypad are mapped to the ports of the microcontroller. Port P3 is used for this purpose. The keys are push button types and they are programmed to represent nos. 0-9 each.

The DIP switch is connected to P2 and the IR circuit which is responsible for the reception is connected to the RX key of P3.

5.2.2 Receiver - Step by Step Working

(a) We connect the 9v battery to the regulator input and from the regulator output we get the 5v required by the microcontroller. Instantaneously the circuit switches on and the LED attached alongside the regulator begins to glow. Also, at the same time the LCD turns on and displays the message "SMS RX".

(b) As soon as we send the data form the transmitter the buzzer attached to the receiver circuit sounds to indicate to us that a message has been sent. But, this only an indication of the fact that the message has been received. We cannot access the actual message until we set the right address and enter the correct password.

(c) If the address at the time of reception of message is wrong then we cannot receive this message. We will have to select the correct address using the DIP switches. The address must match the one in the Transmitter. When we have selected the correct address then we must request the transmission to be done again. Only then will our receiver be able to access the message. When the correct address is selected a message “DATA RECIEVED” will flash on the LCD. This is the visual indication for the reception of the message and matching of the addresses.

(d) After reception of the message we must enter the password for us to be able to access the message. The password can be entered using the keypad provided at the receiver station. To activate the password menu we must press the enter key once the “DATA RECEIVED” message has been displayed. The password that we have used is a 3 digit one and so on pressing the enter key a password menu with three blank spaces is displayed. Using the keys we can enter the password and when we are done we press the enter key. If the password is incorrect a message “FAILED” is displayed and we are directed back to the password menu. When we enter the correct password then the decryption occurs and the message as sent by the transmitter is displayed on the LCD.

(e) We will need to reset the circuit using the manual reset provided when we want to use the circuit again.

CONCLUSION

Looking back at how we had conceived this project at the start and how it turned out in the end we can safely conclude that our aim has been completely achieved. Not only were we able to design the system in the manner that we had originally wanted but were able to surpass our own initial estimates regarding range and efficiency. We are happy to say that we have not only completed this project on a successful note but have also gained immensely in the process. Along with having polished our theoretical skills via this project we have also gained tremendous practical insight into the concepts we have learned over these four years. These lessons will no doubt serve us handily in the future and we are thankful to our project coordinator for giving us this opportunity to work on this project and also for the valuable guidance he provided us with through out the duration of this project.

Seeing the numerous practical applications of our project, some of which even have the potential for making a commercial presence we are glad we choose this subject and hope we might get an opportunity in the future to further our work in this regard.

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