

EMBEDDED SYSTEM INTERNSHIP REPORT

AT CODE BIND TECHNOLOGIES

Submitted in partial fulfillment of the requirements for the completion of

PROFESSIONAL TRAINING

By

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING**

SCHOOL OF ELECTRICAL AND ELECTRONICS

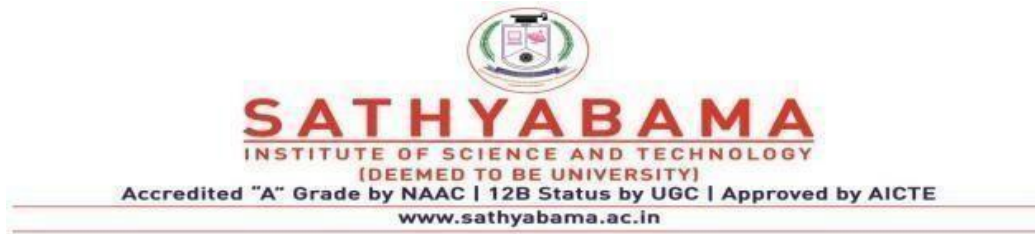
SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with grade “A++” by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI – 600119

OCTOBER 2023



**DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING**

BONAFIDE CERTIFICATE

This is to certify that this Internship Report submitted for EPICS is the bonafide work of **AMAN CHOUHAN** (41140008) who carried out the **EMBEDDED SYSTEM** Internship during the period May 2023 to June 2023.

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External Examiner

DECLARATION

I **AMAN CHOUHAN** hereby declare that the Internship Report Entitled **EMBEDDED SYSTEM** done by me **AT CODE BIND TECHNOLOGIES,CHENNAI** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in ELECTRICAL AND ELECTRONICS ENGINEERING.

DATE: 15 May 23 - 19 May 23

PLACE: CHENNAI



AMAN CHOUHAN

SIGNATURE OF THE CANDIDATE

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CHAPTER 1

INTRODUCTION ABOUT THE COMPANY

1.1 INTRODUCTION

CodeBind Technologies is a certified (ISO 9001:2015), IAF, DAC, which is accredited in the software development, industrial seminars, technical training oriented programs. We are extending the relationship with our clients and making friends in the world around your customers through the digital marketing sectors. Our support is also in optimizing your website in popular search engines that are certified by Google”.

CodeBind Technologies is one of the development infrastructures in various platforms. We are striving to stand the superior position in the competitive world. In which, we mainly focus our infrastructure in the platforms of Website development, Mobile application development, Digital marketing and Embedded Products requirements for all business enterprises globally.

We believe in teamwork among our clients to make a tremendous success associated with different fields of clients in the development sectors like banking, educational, automation, production, manufacturing fields.

In Particular, we are collaborating with 180+ clients and 2000+ projects across the world like Japan, Singapore, China, and Germany.

1.2 Company Profile

CodeBind Technologies is a computer software company based out of Usman Road, Chennai, Tamil Nadu, India.

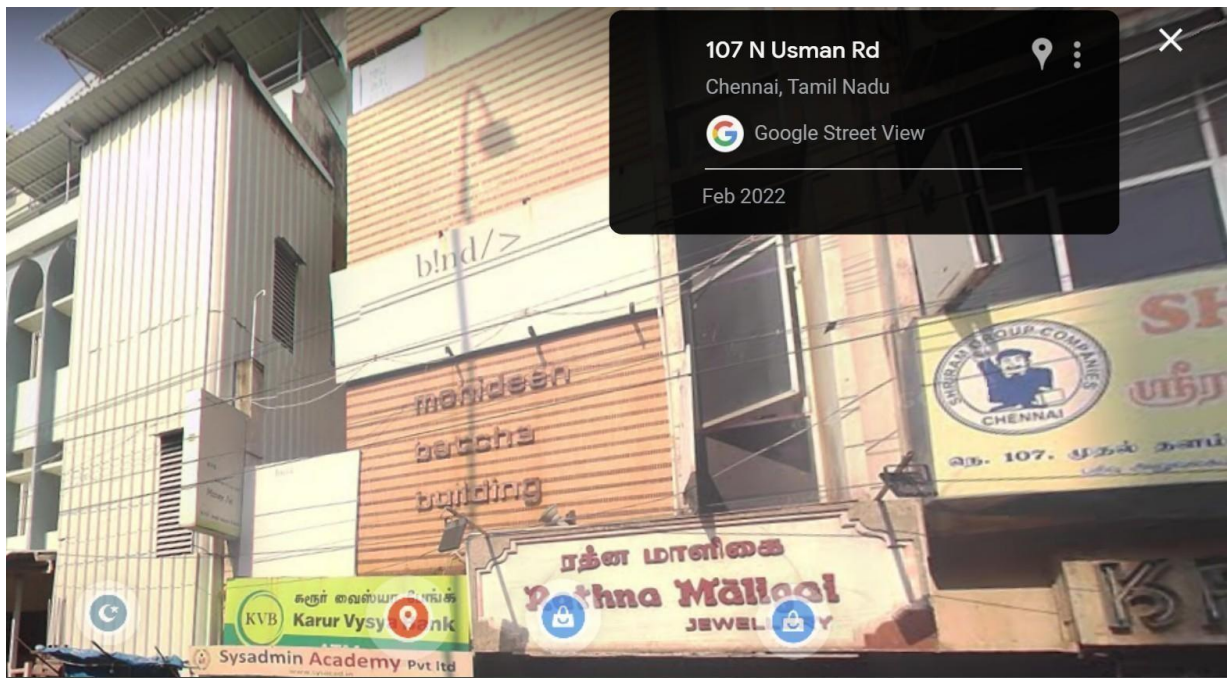


Fig. No. 1 Company View

1.3 Background

The company was founded in Stockholm , Sweden , in 1997 by Lars Liljeryd . A German subsidiary was formed in 2000 as Coding Technologies GmbH (later renamed Dolby Germany GmbH) with support form the research organization Fraunhofer IIS. The company also had offices in the United States and China.

- CodeBind Technologies is a new evolution to supporting the enterprises across the world through designing and developing the websites , application development in different platforms with fulfilling the other marketing requirements.
- We are providing Inplant training and Internship for CSE , IT , ECE , EEE , EIE, ICE , CIVIL , MECH , BSE , MCA etc., with free workshops and free placement training.



Fig. No.:-2 (a)



etail to make Perfect

1.4 Highlights

- They love to design a end Product.
- They Provide support made to be useful and professional.
- We initiate with strong technical resources and passionate entrepreneurs.

f or all of their Themes.

mented for easier Understanding.

le of layouts you can choose from which are

CHAPTER 2

TRAINING ATTENDED

2.1. INTRODUCTION

An Embedded system is any electronic device that incorporates a computer in its implementation. The user of an embedded device is often not even aware that a computer is present in the device. The computer is used primarily to provide flexibility and to simplify the system design. Unlike a PC, program code is usually stored in ROM and not a hard disk drive. Typically, the end user does not develop new software for the embedded device. With advances in VLSI technology, embedded systems have become so inexpensive that they are found in most of today's electronic

Aircraft & Military Systems	Aircraft autopilots, avionics and navigation systems, automatic landing systems, guidance systems, engine controls.
Biomedical Systems	CT scan and Ultrasound imaging systems, patient monitors, heart pacers.
Cars	Engine control, anti-lock braking systems, traction control systems, air bag controls, heating and air conditioning controls, GPS mapping, Satellite Radio, On-board Diagnostics.
Communications	Communication Satellites, network routers, switches, hubs.
Consumer Electronics	TVs, ovens, dishwashers, DVD players, stereos, security systems, lawn sprinkler controls, thermostats, cameras, clock radios, answering machines, set top boxes, other appliances.
Computer Input Output Devices	Keyboards, mice, printers, scanners, displays, modems, hard disk drives, DVD drives, graphics cards, USB devices.
Electronic Instrumentation	Data acquisition systems, oscilloscopes, voltmeters, signal generators, logic analyzers.
Industrial Devices	Elevator controls, surveillance systems, robots, CNC machines, Programmable Logic Controllers, industrial automation and control systems.
Office Machines	FAX machines, copiers, telephones, calculators, cash registers.
Personal Devices	Cell phones, portable MP3 players, Video players, Personal Digital Assistants (PDAs), electronic wrist watches, handheld video games, digital cameras, GPS systems.
Robots	Industrial robots, autonomous vehicles, space exploration robots (i.e. Mars robots)
Toys	Video Game systems, "Aibo", "Furby", and "Elmo" type robot toys.

devices.

Table 1. Embedded System Scope

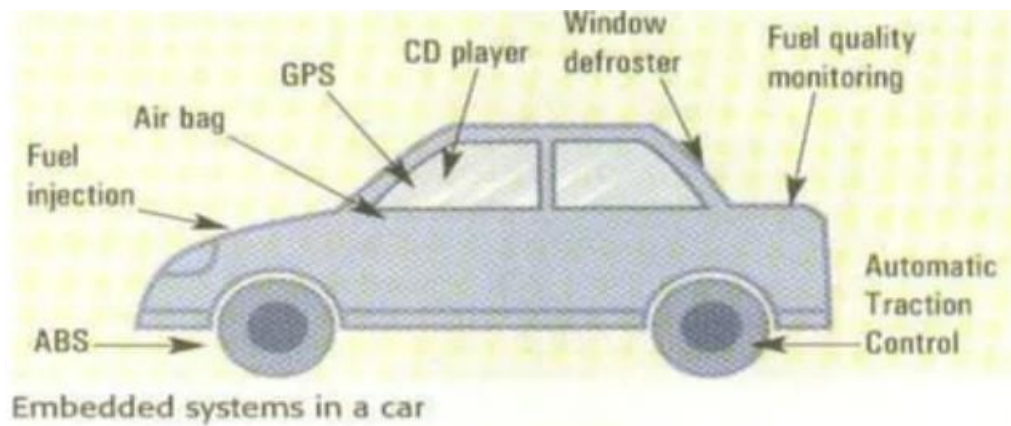


Fig. No.:-3 Real-life example of example of Embedded System

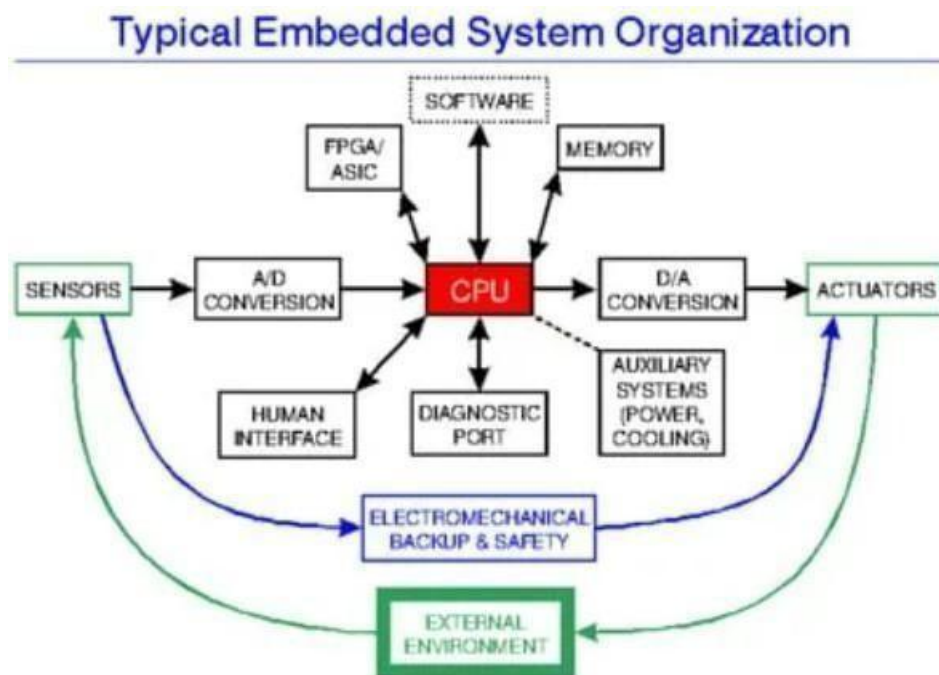


Fig. No.:-4 Embedded System Organization

2.2 Microcontroller v/s Microprocessor

A Microcontroller is a single-chip computer. Micro suggests that the device is small, and the controller suggests that it is used in control applications. Another term for microcontroller is embedded controller, since most of the microcontrollers are built into (or embedded in) the devices they control.

A microprocessor differs from a microcontroller in a number of ways. The main distinction is that a microprocessor requires several other components for its operation, such as program memory and data memory, input-output devices, and an external clock circuit. A microcontroller, on the other hand, has all the support chips incorporated inside its signal chip.

All microcontrollers operate on a set of instructions (or the user program) stored in their memory. A microcontroller fetches the instructions from its program memory one by one, decodes these instructions, and then carries out the required operations. Microcontrollers have traditionally been programmed using the assembly language of the target device. Although the assembly language is fast, it has several disadvantages. An assembly program consists of mnemonics, which makes learning and maintaining a program written using the assembly language difficult. Also, microcontrollers manufactured by different firms have different assembly language, so the user must learn a new language with every new microcontroller he or she uses.

2.3 TYPES OF

MICROCONTROLLERS

First microcontroller

is “8031” FEATURES:

- It is Intel's product. Neither a microprocessor nor a microcontroller.
- It is an 8-bit controller.
- Internally no ROM is provided i.e. code is outside the chip.

Second microcontroller is “8051”

FEATURES

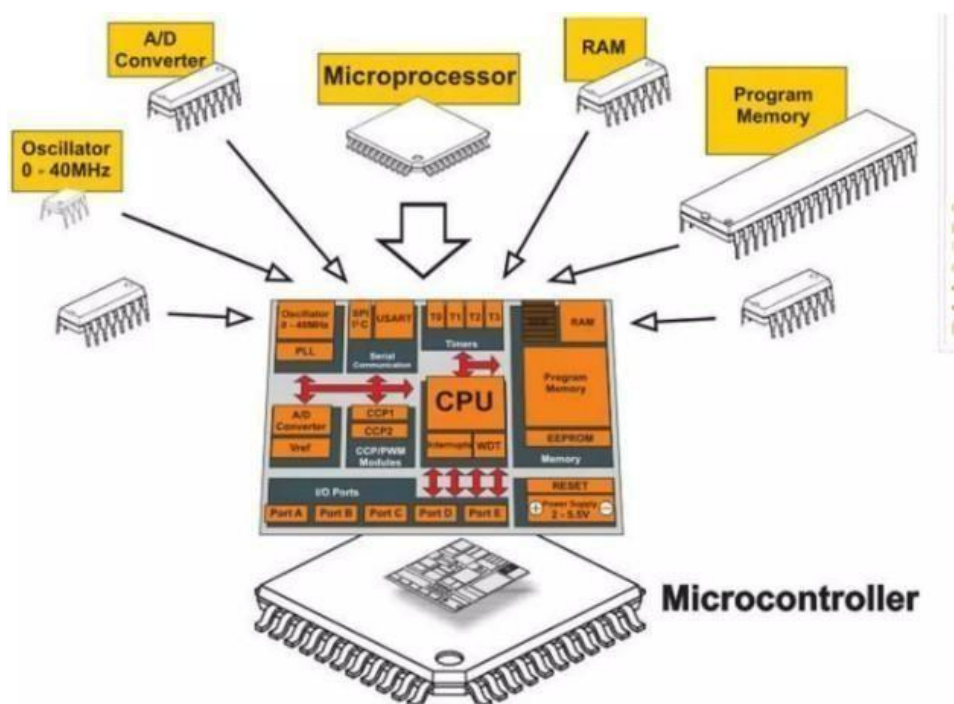
- It is the first complete 8-bit microcontroller.
- It is a name of a family in which the instruction set, pin configuration, architecture are the same, only memory storage capacity is different.
- Internally PROM(programmable read only memory) is provided so it is called one time programmable(OTP).

Third microcontroller is

“AT89C51” FEATURES

- IT is ATMEL's product. It is similar to an 8051 microcontroller i.e., having the same instruction set , pin configuration, and architecture.

In “AT89C51” , c“ stands for CMOS technology used in the manufacturing of the I.C.



CHAPTER 3

EMBEDDED ENVIRONMENT

Microcontrollers used in development projects have very limited resources. We are working close to our target machine and we must be familiar with our target hardware construction and operation.

A good quality C development environment incorporates tools which allow us to concentrate primarily on our application and not on the hardware which runs them. However, we cannot ignore low-level details of our target hardware. The better we understand our run-time environment, the better we can take advantage of its limited capabilities and resources.

3.1 EMBEDDED DIFFERENCE

There are many aspects of embedded system developments which must be considered. These are:

RELIABILITY Embedded systems must be reliable. Personal computer programs such as word processors and games do not need to achieve the same standard of reliability that a microcontroller application must. Errors in programs such as word processors may result in errors in a document or loss of data. An error in a microcontroller application such as a television remote control or compact disc player will result in a product that does not work and consequently does not sell. An error in a microcontroller application such as an antilock braking system or autopilot could be fatal.

EFFICIENCY Issues of efficiency must be considered in real time applications. A real time application is one in which must be able to act at a speed corresponding with the occurrence of an actual process.

COST Many embedded systems must compete in a consumer market and cost is an important issue in project development.

3.2 FABRICATION TECHNIQUE

CMOS Complementary Metal Oxide Semiconductor (CMOS) is a technique commonly used to fabricate microcontrollers. CMOS requires less power and CMOS chips can be static which allows the implementation of a sleep mode. CMOS microcontrollers must have all inputs connected to something.

PMP Post Metal Programming (PMP) allows ROM to be programmed after final metallization. This allows ROM to be programmed very late in the production cycle.

3.3 MEMORY ADDRESSING AND TYPES

Each microcontroller has a specific addressing range. An addressing range is the number of addresses a microcontroller can access. The addressing scheme used to access these spaces varies from processor to processor, but the underlying hardware is similar.

3.3.1 RAM

Random access memory or RAM consists of memory addresses. The CPU can both read from and write to RAM, is used for data memory and allows the CPU to create and modify data as it executes the application program. RAM is volatile, it holds its contents only as long as it has a constant power supply. If power to the chip is turned off, the contents of RAM are lost. This does not mean that RAM contents are lost during a chip reset. Vital state information or other data can be recorded in data memory and recovered after an interrupt or reset. Some chips provide an alternate RAM power supply so that memory contents can be maintained even when the rest of the chip is without power. This does not make RAM any less volatile, without a backup power source the contents would still be lost. This type of RAM is called battery ***backed-up static RAM***.

3.3.2 ROM

ROM, read only memory, is typically used for program instructions. The ROM in a microcontroller usually holds the final application program. Maskable ROM is memory space that must be burned in by the manufacturer of the chip as is constructed. To do this, we must provide the chip builder with the ROM contents we wish the chip to have. The manufacturer will then mask out appropriate ROM blocks and hardware the information you have provided.

Since recording chip ROM contents is part of the manufacturing process, it is a costly one-time expense. If we intend to use a small number of parts, we may be better off using chips with PROM. If we intend to use a large number of parts for our application, then the one-time expense of placing our program in ROM is more feasible.

3.3.3 PROM

Programmable ROM, or PROM, started as an expensive means to prototype and test application code before burning ROM. In recent years PROM has gained popularity to the point where many developers consider it a superior alternative to burning ROM. As microcontroller applications become more specialized and complex, needs for maintenance and support rise. Many developers use PROM devices to provide software updates to customers without the cost of sending out new hardware. There are many programmable ROM technologies available which all provide a similar service. A special technique is used to erase the contents of programmable ROM then a special method is used to program new instructions into the ROM. Often, the developer uses separate hardware to perform each of these steps.

3.3.4 EPROM

EPROM (erasable programmable ROM) is not volatile and is read only. Chips with EPROM have a quartz window on the chip. Direct exposure to ultraviolet radiation will erase the EPROM contents. EPROM devices typically ship with a shutter to cover the quartz window and prevent ambient UV from affecting the memory. Often the shutter is a sticker placed on the window. Developers use an

memory with high-intensity UV light. To reprogram the chip, an EPROM programmer is used, a device which writes instructions into EPROM. The default, blank state for an EPROM device has each block of memory set. When we erase an EPROM we are really setting all memory blocks to 1. Reprogramming the device resets or clears the appropriate EPROM bits to 0. Because of the way EPROM storage is erased, we can't selectively delete portions of EPROM when we erase the memory we must clear the entire storage space.

3.3.5 EEPROM

EEPROM (electrically erasable programmable ROM) devices have a significant advantage over EPROM devices as they allow selective erasing of memory sections. EEPROM devices use high voltage to erase and reprogram each memory block. Some devices require an external power source to provide the voltage necessary for erasing and writing and some have an onboard pump which the chip can use to build up a charge of the required voltage. Developers can reprogram EEPROM devices while the chip is operating. However, EEPROM that can be rewritten is usually restricted to data memory storage. EEPROM storage used as program memory typically requires the use of an external power source and a programmer just like EPROM storage.

The most common use for EEPROM is recording and maintaining configuration data vital to the application. For example, many modems use EEPROM storage to record the current configuration settings. This makes the configuration available to the modem user after cycling the power on the modem. Often the default or factory configuration settings are stored in ROM and the user can issue a command to restore default settings by overwriting the current contents of EEPROM with the default information. Sometimes chip manufacturers build EEPROM blocks into the chip for last-minute configuration options. This saves manufacturers money as they can design and fabricate a single chip and then set the EEPROM blocks to provide special purpose versions with specific capabilities. This method is often used to produce microcontroller versions for use on an evaluation board where chip access to its own onboard ROM is turned off and replaced with external EPROM or EEPROM storage. This allows

developers to test application code in cycles by downloading it to the board,

programming the code into the EPROM or EEPROM, and debugging it as it executes in the target hardware.

3.3.6 FLASH MEMORY

Flash memory is an economical compromise between EEPROM and EPROM technology. As with EEPROM high voltage is applied to erase and rewrite flash memory. However, unlike EEPROM, you can not selectively erase portions of flash memory- you must erase the entire block as with EEPROM devices. Many manufacturers are turning to flash memory. It has the advantages of not requiring special hardware and being inexpensive enough to use in quantity. Manufacturers often provide customers with microcontroller products whose ROM is loaded with a boot or configuration kernel where the application code is written into flash memory. When the manufacturer wants to provide the customer with added functionality or a maintenance update, the hardware can be reprogrammed on site without installing new physical parts. The hardware is placed into configuration mode which hands control to the kernel written in ROM. This kernel then handles the software steps needed to erase and re-write the contents of the flash memory. Another useful implementation of flash memory includes a device which can connect electronically to the manufacturer's computer, downloads the latest version of the control application and writes this application to flash memory. Such elaborate applications are typically beyond the resources of an 8 bit microcontroller; we mention the example to show the advantage of programmable ROM technologies.

3.3.7 REGISTERS

The CPU maintains a set of registers which it uses to store information. Registers are used to control program execution and maintain intermediate values needed to perform required calculations. Some microcontrollers provide access to CPU registers for temporary storage purposes. This can be extremely dangerous as the CPU can at any time overwrite a register being used for its designated purpose. 8 bit microcontrollers do not often provide resources for register memory outside the CPU. This means that the C register keyword is

implementations will set aside RAM for special purpose pseudo-registers to use when your application attempts certain operations. For example, if you attempt a 16 bit math operation, the compiler can dedicate a portion of base page RAM for 16 bit pseudo-registers which store values during math operations. You can use these special registers for temporary purposes in places where your code will not require them for their intended purpose. You must be careful, if the compiler uses a pseudo-register it will overwrite current contents.

3.4 AT89C51

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 TM 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.

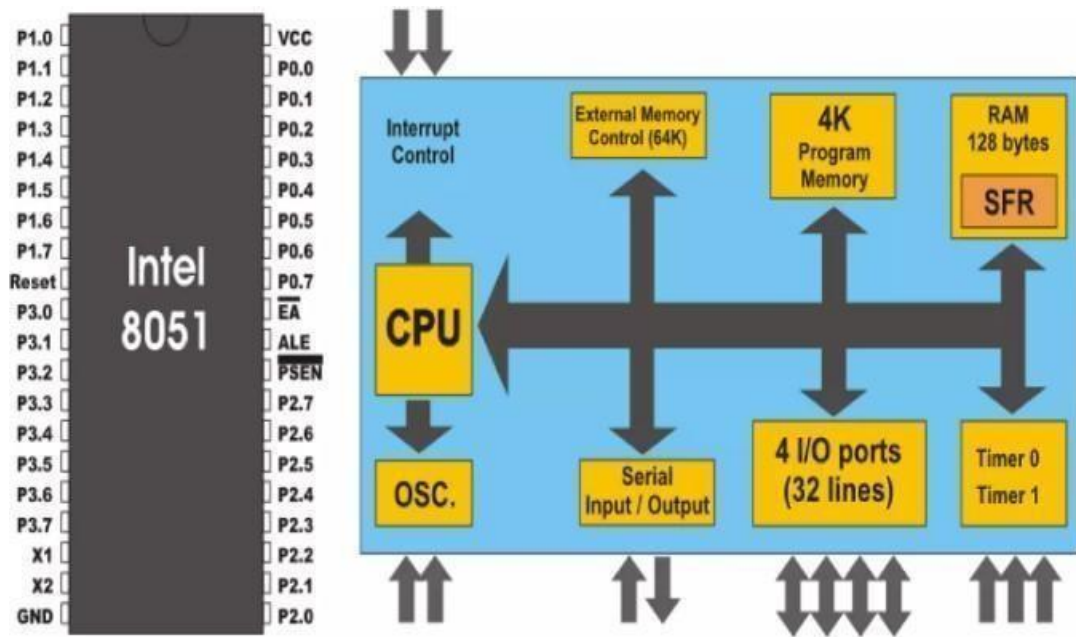


Fig. No.:-6 Pin Diagram and architecture of AT89C51

PIN DESCRIPTION

VCC Supply voltage.

GND Ground.

PORT 0 is an 8-bit open drain bidirectional I/O port. As an output port each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high impedance inputs.

Port 0 may also be configured to be the multiplexed low order address/data bus during accesses to external programs and data memory. In this mode PO has internal pull ups. Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pull ups are required during program verification.

PORT 1 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

that are externally being pulled low will source current (IIL) because of the internal pull ups. Port 1 also receives the low-order address bytes low-order address bytes during Flash programming and verification.

PORT 2 is an 8-bit bidirectional I/O port with internal pull ups. The Port 2 output buffers can sink/source four TTL inputs. When Is are written to Port 2 pins they are pulled high by the internal pull ups 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 pull ups. 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 Is. During access to external data memory that uses 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 is an 8-bit bidirectional I/O port with internal pull ups. The Port 3 output buffers can sink/source four TTL inputs. When Is are written to Port 3 pins they are pulled high by the internal pull ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull ups. Port 3 also serves the functions of various special features of the AT89C51 as listed below:

Port Pin Alternate Functions

P3.0 RXD (serial input

port) P3.1 TXD (serial output

port) P3.2 INTO (external

interrupt 0) P3.3 INTI

(external interrupt 1)

P3.4 TO (timer0

external input) P3.T(timer

external

input)P3.6 WR

(external data memory

write strobe) P3.7 RD

(external data memory read

strobe)

Port 3 also receives some control signals for Flash programming and verification.

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

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

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

EA/VPP External Access Enable. EA must be strapped to GND in order to enable the devices 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.

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

XTAL2 Output from the inverting oscillator amplifier.

MEMORY SPACE ALLOCATION The 8051 has three very general types of memory. To effectively program the 8051 it is necessary to have a basic understanding of these memory types. The memory types are illustrated in the following graphic. They are: On-Chip Memory, External Code Memory, and External RAM.

On Chip ROM The 89C51 has a 4K bytes of on-chip ROM. This 4K bytes ROM memory has memory addresses of 0000 to 0FFFh. Program addresses higher than 0FFFh, which exceed the internal ROM capacity will cause the microcontroller to automatically fetch code bytes from external memory, Code bytes can also be fetched exclusively from an external memory, addresses 0000h to FFFFh, by connecting the external access pin to ground. The program counter doesn't care where the code is: the circuit designer decides whether the code is found totally in internal ROM, totally in external ROM or in a combination of internal and external ROM.

On Chip RAM The 128 bytes of RAM inside the 8051 are assigned addresses 00 to 7Fh. These 128 bytes can be divided into three different groups as follows:

A total of 32 bytes from locations 00 to 1Fh are set aside for register banks and the stack.

A total of 16 bytes from locations 20h to 2Fh are set aside for bit addressable read/write memory and instructions.

A total of 80 bytes from locations 30h to 7Fh are used for read and write storage, or what is normally called a scratch pad. These 80 locations of RAM are widely used for the purpose of storing data and parameters by 8051 programmers.

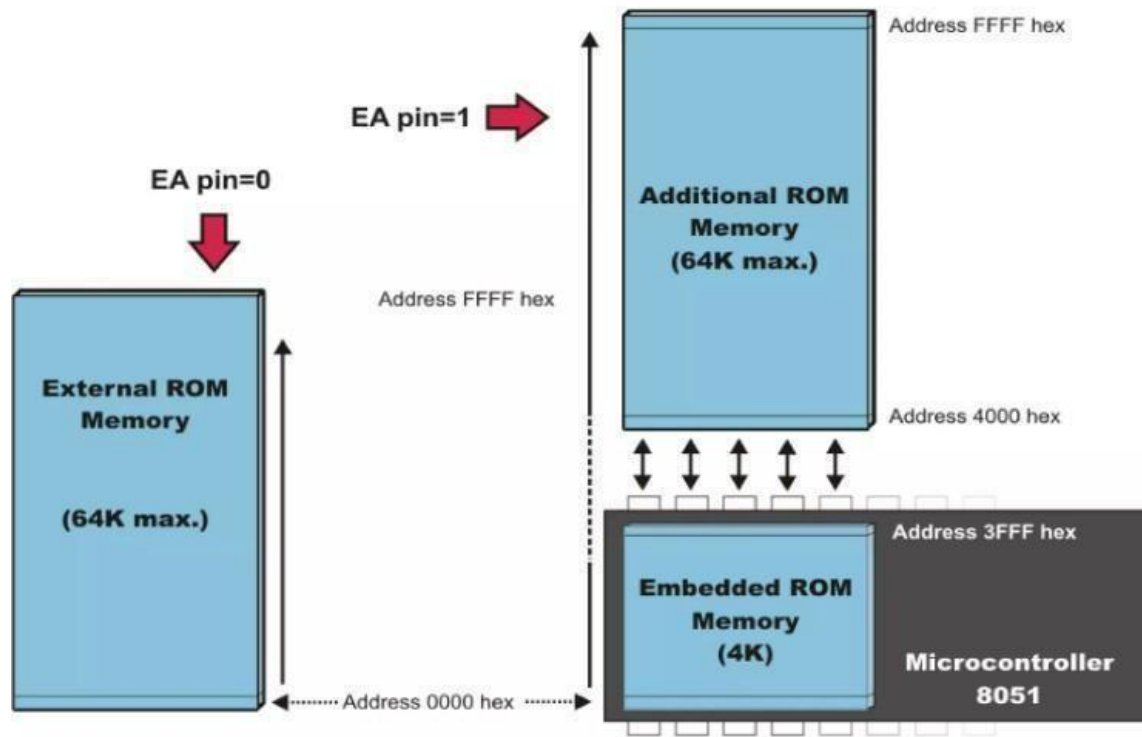


Fig. No.:7 ROM & RAM Memory in 8051 Microcontroller

External Code Memory

External Code Memory is code (or program) memory that resides off-chip. This is often in the form of an external EEPROM.

External RAM

External RAM is RAM memory that resides off-chip. This is often in the form of standard static RAM or flash. Any memory (Code, RAM, or other) that physically exists on the microcontroller itself. On-chip memory can be of several types, but we'll get into that shortly. External RAM As an obvious opposite of Internal RAM, the 8051 also supports what is called External RAM. As the name suggests, External RAM is any random access memory which is found off-chip. Since the memory is off-chip it is not as flexible in terms of accessing, and is also slower. For example, to increment an Internal RAM location by 1 requires only 1 instruction and 1

instruction cycle. To increment a 1-byte value stored in External RAM requires 4 instructions and 7 instruction cycles. In this case, external memory is 7 times slower!

Code Memory:

Code memory is the memory that holds the actual 8051 program that is to be run. This memory is limited to 64K and comes in many shapes and sizes: Code memory may be found on-chip, either burned into the microcontroller as ROM or EPROM. Code may also be stored completely off-chip in an external ROM or, more commonly, an external EEPROM. Flash RAM is also another popular method of storing a program. Various combinations of these memory types may also be used--that is to say, it is possible to have 4K of code memory on-chip and 64k of code memory off-chip in an EPROM.

Registers

In the CPU, registers are used to store information temporarily. That information could be a byte of data to be processed, or an address pointing to the data to be fetched. In the 8051 there used only one data type: 8 bits. With an 8-bit data type, any data larger than 8 bits has to be broken into 8-bit chunks before it is processed.

The most commonly used registers of the 8051 are A(accumulator), B, RO, R1, R2, R3, R4, R5, R6, R7, DPTR (data pointer) and PC (program counter). All the above registers are 8-bit registers except DPTR and the program counter. The accumulator A is used for all arithmetic and logic instructions.

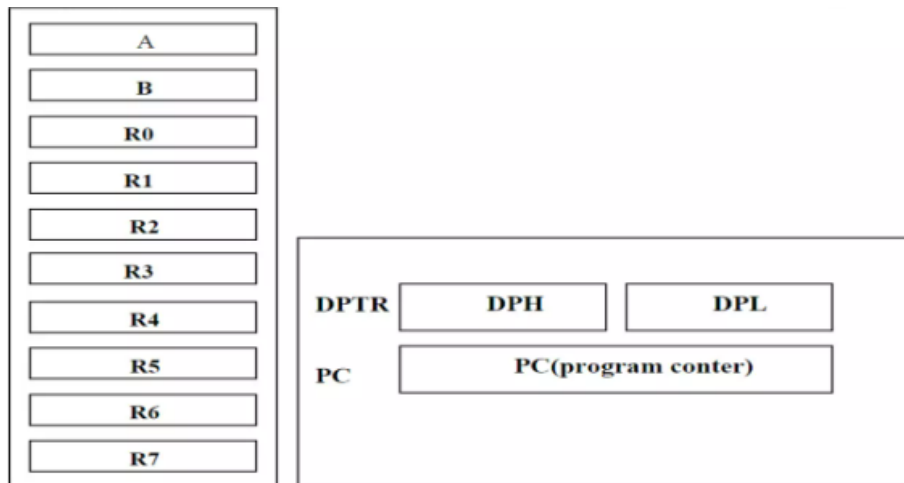


Fig. No.: -8 Some 8-bit registers & 16-bit registers

Program Counter and Data Pointer

The program counter is a 16-bit register and it points to the address of the next instruction to be executed. As the CPU fetches op-code from the program ROM, the program counter is incremented to point to the next instruction. Since the PC is 16 bit wide, it can access program addresses 0000h to FFFFH, a total of 64K bytes of code. However, not all the members of the 8051 have the entire 64K bytes of on-chip ROM installed.

The DPTR register is made up of two 8-bit registers, DPH and DPL, which are used to furnish memory addresses for internal and external data access. The DPTR is under the control of program instructions and can be specified by its name, DPTR. DPTR does not have a single internal address, DPH and DPL are assigned an address each.

Flag bits and the PSW Register

Like any other microprocessor, the 8051 has a flag register to indicate arithmetic conditions such as the carry bit. The flag register in the 8051 is called the program status word (PSW) register.

The program status word (PSW) register is an 8-bit register. It is also referred to as the flag register.

Although the PSW register is 8-bit wide, only 6 bits of it are used by the microcontroller. The two unused bits are user definable flags. Four of the flags are conditional flags, meaning they indicate some conditions that resulted after an instruction was executed. These four are CY (carry), AC (auxiliary carry), P (parity), and OV (overflow). The bits of the PSW register are shown below:

CY PSW.7 Carry flag

AC PSW.6 Auxiliary carry flag

PSW.5 Available to the user for general purpose

RSI PSW.6 Register bank selector bit I RSO PSW.3 Register

bank selector bit OV PSW.2 Overflow flag,

FO PSW.1 User

definable bit PPSW.0

Parity flag **CY, the**

carry flag

This flag is set whenever there is a carry out from the d7 bit. This flag bit is affected after an 8-bit addition or subtraction. It can also be set to 1 or 0 directly by an instruction such as "SETB C" and "CLR C" where "SETB C" stands for set bit carry and "CLR C" for clear carry.

AC, the auxiliary carry flag

If there is carry from D3 to D4 during an ADD or SUB operation, this bit is set; otherwise cleared. This flag is used by instructions that perform BCD arithmetic.

P, the parity flag

The parity flag reflects the number of 1s in the accumulator register only. If the register A contains an odd number of 1s, then P=1. Therefore, P=0 if A has an even number of 1s.

CHAPTER 4

COMPONENT DESCRIPTION

4.1 RESISTOR

Resistors restrict the flow of electric current, for example a resistor is placed in series with a light emitting diode(LED) to limit the current passing through the LED.

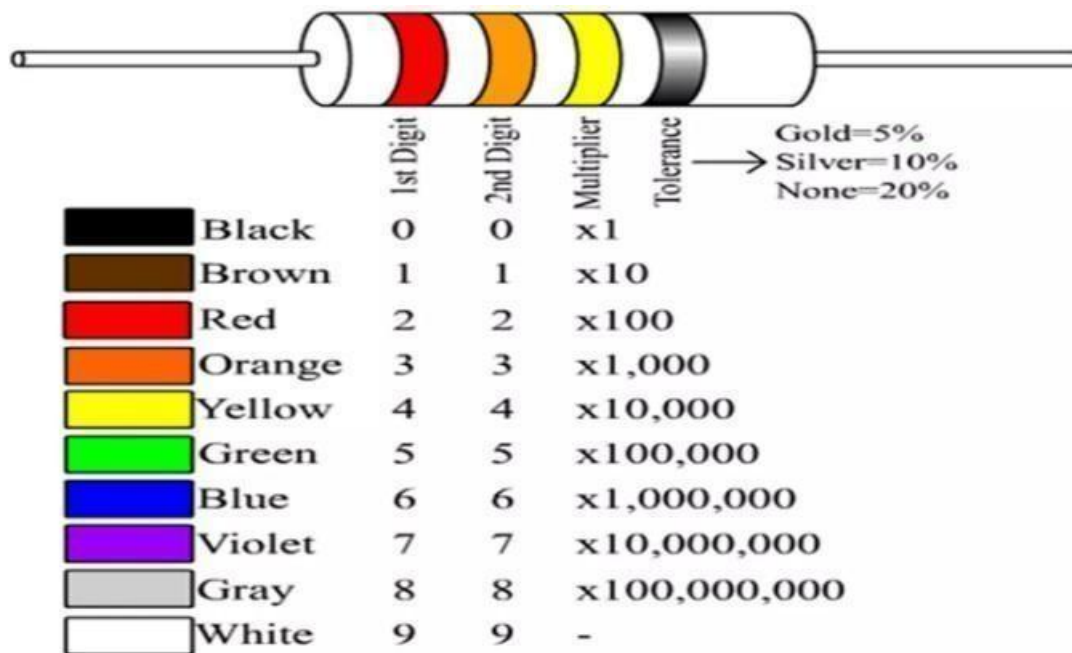
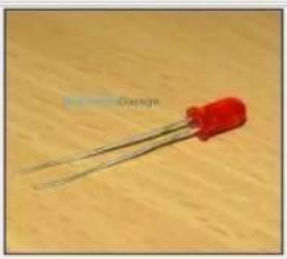


Fig. No.:9 Resistor Color Coding

4.2 LED , Infrared LED,BC547,& 7-Segment Display



[LED](#)

Light emitting diodes (LEDs) are semiconductor light sources.

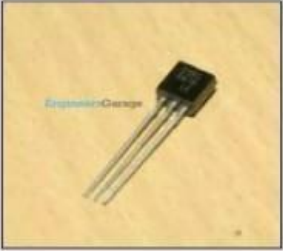
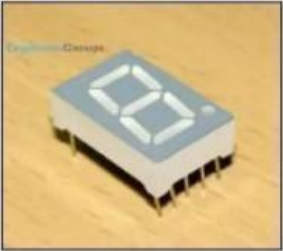
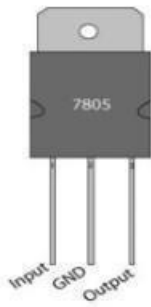
	<u>Infrared LED</u> An IR LED, also known as IR transmitter, is a special purpose <u>LED</u> that transmits infrared rays in the range of 760 nm wavelength.
	<u>Transistor BC547</u> BC547 is an NPN bi-polar junction transistor. A transistor, stands for transfer of resistance, is commonly used to amplify current.
	<u>Seven Segment Display</u> A seven segment display is the most basic electronic display device that can display digits from 0-9. They find wide application in devices that display numeric information like digital clocks, radio, microwave ovens etc.

Fig .No.:-10 LED , Infrared LED, BC547,7-Segment Display

4.3 IC 7805 (Voltage Regulator IC)

7805 is a **voltage regulator** integrated circuit. It is a member of the 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The **voltage regulator IC** maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

Pin Description:



Pin No	Function	Name
1	Input voltage (5V-18V)	Input
2	Ground (0V)	Ground
3	Regulated output; 5V (4.8V-5.2V)	Output

Fig.11

Table 2.Pin Description of 7805

4.4 LM324 IC

LM324 is a 14 pin IC consisting of four independent operational amplifiers (op-amps) compensated in a single package. Op-amps are high gain electronic voltage amplifiers with differential input and, usually, a single-ended output. The output voltage is many times higher than the voltage difference between input terminals of an op-amp.

These op-amps are operated by a single power supply LM324 and need for a dual supply is eliminated. They can be used as amplifiers, comparators, oscillators, rectifiers etc. The conventional op-amp applications can be more easily implemented with LM324.

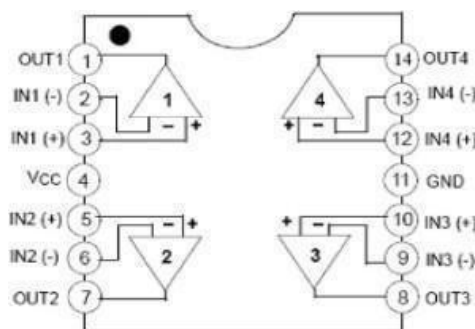


Fig. No.:-12 LM324 IC

Pin Description

Pin No	Function	Name
1	Output of 1 st comparator	Output 1
2	Inverting input of 1 st comparator	Input 1-
3	Non-inverting input of 1 st comparator	Input 1+
4	Supply voltage; 5V (up to 32V)	Vcc
5	Non-inverting input of 2 nd comparator	Input 2+

6	Inverting input of 2 nd comparator	Input 2-
7	Output of 2 nd comparator	Output 2
8	Output of 3 rd comparator	Output 3
9	Inverting input of 3 rd comparator	Input 3-
10	Non-inverting input of 3 rd comparator	Input 3+
11	Ground (0V)	Ground
12	Non-inverting input of 4 th comparator	Input 4+
13	Inverting input of 4 th comparator	Input 4-
14	Output of 4 th comparator	Output 4

Table 3. Pin Description of LM 324 Ic

4.5 555 Timer IC

555 is a very commonly used IC for generating accurate timing pulses. It is an 8 pin timer IC and has mainly two modes of operation: monostable and astable. In monostable mode time delay of the pulses can be precisely controlled by an external resistor and a capacitor whereas in astable mode the frequency & duty cycle are controlled by two external resistors and a capacitor. 555 is very commonly used for generating time delays and pulses.

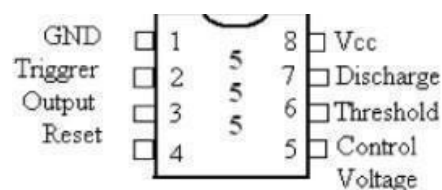


Fig. 13

Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Voltage below $1/3 V_{cc}$ to trigger the pulse	Trigger
3	Pulsating output	Output
4	Active low; interrupts the timing interval at Output	Reset
5	Provides access to the internal voltage divider; default $2/3 V_{cc}$	Control Voltage
6	The pulse ends when the voltage is greater than Control	Threshold
7	Open collector output; to discharge the capacitor	Discharge
8	Supply voltage; 5V (4.5V - 16 V)	V _{cc}

Table 4. Pin Description of 555 Timer IC

4.6 RF Module

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of the carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources.

This RF module comprises an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder HT12E-HT12D. HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.



Fig. No.:-14 RF Transmitter & RF

Receiver Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data input pin	Data
3	Supply voltage; 5V	Vcc
4	Antenna output pin	ANT

Table 6. Pin Description of RF Receiver

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data output pin	Data
3	Linear output pin; not connected	NC
4	Supply voltage; 5V	Vcc
5	Supply voltage; 5V	Vcc
6	Ground (0V)	Ground
7	Ground (0V)	Ground
8	Antenna input pin	ANT

Table 7. Pin Description of RF Receiver

4.7 LCD

LCD (Liquid Crystal Display) screen is an electronic display module and finds a wide range of applications. A 16x2 LCD display is a very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

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

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

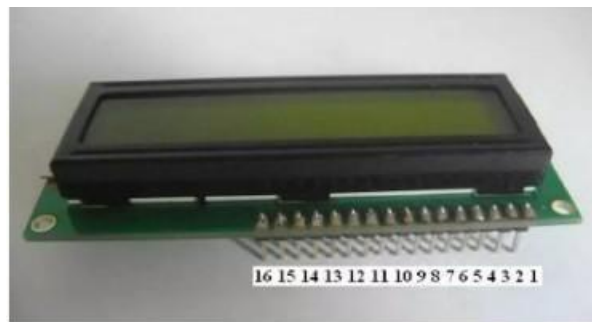


Fig.No.:15 LCD Display

Pin Description:

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

Table 8. Pin Description of LCD

4.8 TRANSFORMER:

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC. The two types of transformers are:

Step-up transformers increase voltage, Step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage. The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils, instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core.

Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up. The ratio of the number of turns on each coil, called the turns ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.



Fig.16 Transformer

CHAPTER 5

BIDIRECTIONAL VISITOR COUNTER & HOME AUTOMATION

5.1 PROJECT OVERVIEW

This Project "Bi-directional Visitor Counter and Home Automation" using Microcontroller is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately. When somebody enters into the room then the counter is incremented by one and the light in the room will be switched ON and when anyone leaves the room then the counter is decremented by one. The light will be only switched OFF until all the persons in the room go out. The total number of persons inside the room is also displayed on the seven segment displays.

The microcontroller does the above job. It receives the signals from the sensors, and this signal is operated under the control of software which is stored in ROM. Microcontroller AT89S52 continuously monitor the Infrared Receivers, When any object pass through the IR Receiver then the IR Rays falling on the receiver are obstructed, this obstruction is sensed by the Microcontroller.

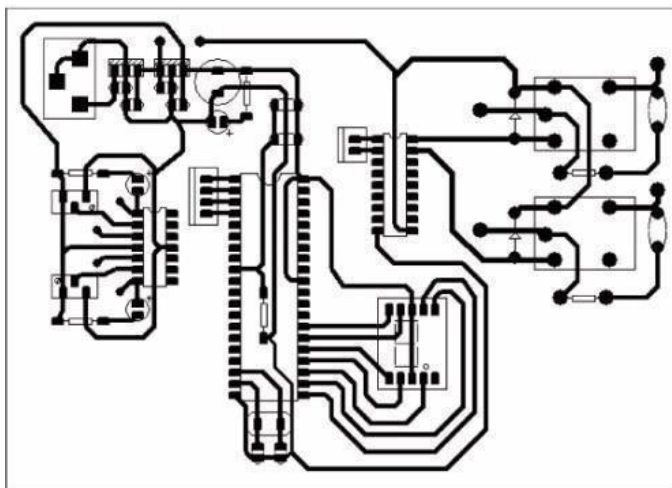


Fig. No.:-17 PCB Layout Of BDVC

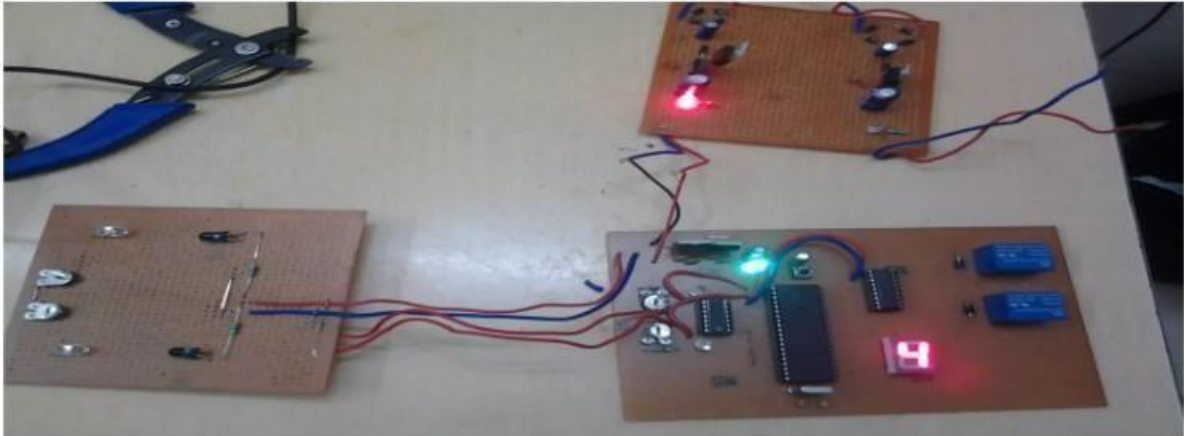


Fig. No.:-18 Circuit Description

5.2 CIRCUIT COMPONENTS

- 5 Resistor of 330 ohms
- Variable Resistor of 20 Kohms
- Variable Resistor of 50k Ohms
- Electrolytic Capacitor
- 4 Ceramic Capacitor 104
- Ceramic Capacitor 33 p
- 11.0592 MHz crystal Oscillator
- AT89552
- 7805
- 7812
- LED
- Reset Key
- Relay
- ULN2803 Relay Driver IC
- LM324 IC
- IR LED
- IR Phototransistor

5.3 CIRCUIT DESIGN

The heart of the circuit design lies in designing the microcontroller interface. Here we use the microcontroller AT8952. The microcontroller AT8952 is interfaced to the IR sensor pairs at two ports pins-P1.0 and P1.1 respectively. The 7 segment display is interfaced with the microcontroller at port P2. Another important aspect of the design involves designing the oscillator circuit and the reset circuit. The oscillator circuit is designed by selecting a 11.0592MHz quartz crystal and two ceramic capacitors- each 33pF. The reset circuit is designed by selecting an electrolyte capacitor of 10uF to ensure a reset pulse width of 100ms and reset pin voltage drop of 12V. The sensor circuit is designed by selecting appropriate value of resistors for both the LED and the phototransistor.

5.4 OPERATION

When the system is powered, the compiler initially initializes the stack pointer and all other variables. It then scans the input ports (PortP10 first). In the meantime, when there is no interruption between the IR LED and the phototransistor of the first sensor pair, the output of the phototransistor is always at low voltage. In other words port P10 is at a logic low level. Now when a tramite takes place, a logic high level is received at port P10, the compiler sees this as an interruption to sense the presence of a person or an object between the IR LED and the phototransistor. As per the program, the count value is increased and this value is displayed on the Counter. Now the compiler starts scanning the other i.e. P1.1. Similar to the first sensor pair, for this sensor pair also the phototransistor conducts in absence of any interruption and P1.1 is at logic low level. In case of an interruption, the pin P1.1 goes high and this interruption is perceived by decreasing the value of count. The program ensures that the scanning of both the port pins is done at certain delays so as to avoid confusion of reading. For instance port P1.0 is scanned for two or three interruptions so as to ensure the count value is above 1 or 2.

5.5 APPLICATIONS

1. This circuit can be used domestically to get an indication of the number of persons entering a party.
2. It can be used at official meetings.

3. It can be used at homes and other places to keep a check on the number of persons entering a secured place.
4. It can also be used as a home automation system to ensure energy saving by switching on the loads and fans only when needed.

5.6 LIMITATIONS

1. It is a theoretical circuit and may require few changes in practical implementation.
2. It is a low range circuit and cannot be implemented at large areas.
3. With frequent change in the count value, after a certain time the output may look confusing.

CHAPTER 6

CONCLUSION

6.1 LESSON LEARNED

- Basics of Embedded System
- Medium Level circuit designing involving microcontroller
- Fault Diagnosis in circuit
- PCB designing and embedded C programming
- Introduction of various electronics component

6.2 KEY LEARNING

- Enhancement in technical knowledge
- Work experience with professional
- . Industrial Exposure

6.3 KNOWLEDGE GAINED

The training at CMC Academy, Jaipur provided me an insight on embedded system technology and recent trends in industry. This training also helped me in my overall personality development by interaction with many trainees and the staff members. It provided me with Industrial Exposure, and working experience with real life professionals which will certainly help me in my career ahead.

6.4 INTERNSHIP COMPLETION CERTIFICATE



Fig: 19 INTERNSHIP COMPLETION CERTIFICATE

REFERENCE

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