AMBIENT NAVIGATION SYSTEM

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BONAFIDE CERTIFICATE

Certified that this project report entitled "**AMBIENT NAVIGATION SYSTEM**" is the bonafide work of **Mr.D.SHYAMNATH** [Reg. no. 0710107098], **Mr.T.SIRAGIRI ADITHIYA** [Reg. No. 0710107099], **Mr.K.VARUN PRAKASH** [Reg. no. 0710107109] who carried out the research under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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Internal Examiner 19/4/11

External Examiner

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ABSTRACT

Robotic aids, used widely in areas such as health care and home assistance, require cooperation between humans and robots. The proper control commands for such systems would be a combination of autonomous commands from robots and commands from humans, rather than either autonomous commands or solely human commands.

Human sensing is dominated by sight. It is interesting to see what happens if sight is impaired and how robots can work things out together with human partners in this situation

This project is nominated to show the way for blind people using ambient navigation system. The overall Strategy is regulated by PIC 16F877A Microcontroller High-Performance RISC processor, Ultrasonic sensor which is used to sense the obstacles, APR 9600 IC is used for voice recording& playback solution, switches and LCD display. When the person presses the command switch, the robot directs the person to their desire destination. During locomotion if any obstacles detected by sensor the voice annunciation will give information about obstacles and changes its direction. While command switch is not pressed robot will stop its motion.

The application of this project can be extended in various places like super market, universities, hospitals and also can be used for assisting blind people for road crossing.

This project is use to take the blind people safely to their destination.

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LIST OF ABBREVIATIONS

PIC	-------	Peripheral Interface Controller
RISC	-------	Reduced Instruction Set Controller
LCD	-------	Liquid Crystal Display
MCU	-------	Microcontroller Unit

CHAPTER 1

INTRODUCTION

1.1INTRODUCTION

A human-friendly interactive system that based on the harmonious symbiotic coexistence of humans and robot is explored. Based on the technology paradigm, a robotic cane is proposed for visually impaired people to navigate safely and quickly through obstacles and other hazards.

Our goal is to develop a robotic aid system capable of interacting with its environment and eventually with humans. We outline a set of hardware solutions and working methodologies that can be used for successfully implementing and extending the interactive technology to coordinate humans and robots in complicated and unstructured environments.

1.2. METHODOLOGY OF THE STUDY

The issues discussed include methodologies for human robot interactions, design issues of an interactive robotic cane, hardware requirements for efficient human-robot interactions, and behavior arbitration methodologies for navigation planning.

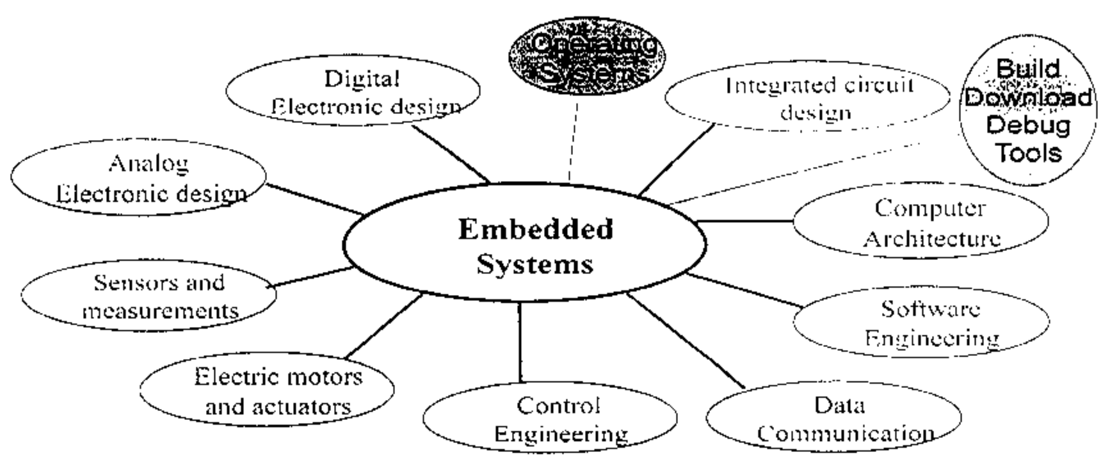
1.3. INTRODUCTION TO EMBEDDEDSYSTEMS

1.3.1. Embedded system

Embedded System is a combination of hardware and software used to achieve a single specific task. An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market.

An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded & lower end embedded systems. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples Personal Digital Assistant and Mobile phones etc .Lower end embedded systems - Generally 8,16 Bit Controllers used with an minimal operating systems and hardware layout designed for the specific purpose. Examples Small controllers and devices in our everyday life like Washing Machine, Microwave Ovens, where they are embedded in.

1.3.2. Embedded system design calls



Embedded system design calls on many disciplines

Fig 1.1 Embedded system design calls

1.3.3 .Embedded system design cycle

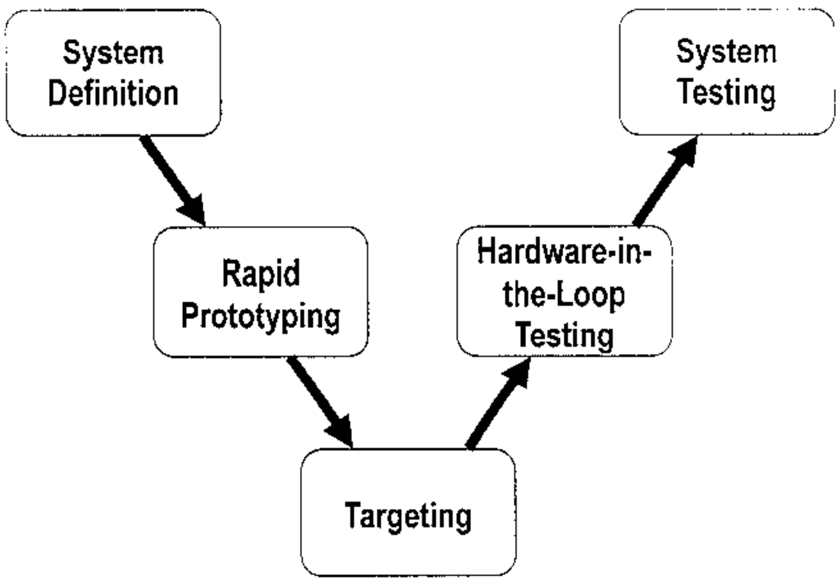


Fig 1.2 Embedded system design cycle

In this place we need to discuss the role of simulation software, real-time systems and data acquisition in dynamic test applications. Traditional testing is referred to as "static" testing where functionality of components is tested by providing known inputs and measuring outputs. Today there is more pressure to get products to market faster and reduce design cycle times. This has led to a need for "dynamic" testing where components are tested while in use with the entire system – either real or simulated. Because of cost and safety concerns, simulating the rest of the system with real-time hardware is preferred to testing components in the actual real system.

The diagram shown on this slide is the "V Diagram" that is often used to describe the development cycle. Originally developed to encapsulate the design process of software applications, many different versions of this diagram can be found to describe different product design cycles. Here we have shown one example of such a diagram representing the design cycle of embedded control applications common to automotive, aerospace and defense applications.

In this diagram the general progression in time of the development stages is shown from left to right. Note however that this is often an iterative process and the actual development will not proceed linearly through these steps. The goal of rapid development is to make this cycle as efficient as possible by minimizing the iterations required for a design. If the x-axis of the diagram is thought of as time, the goal is to narrow the "V" as much as possible and thereby reduce development time.

As the system is divided into sub-systems and components, the process becomes very low-level down to the point of loading code onto individual processors. Afterwards components are integrated and tested together until such time that the entire system can enter final production testing. Therefore the top of the diagram represents the high-level system view and the bottom of the diagram represents a very low-level view.

1.3.4. Characteristics of Embedded System:

- An embedded system is any computer system hidden inside a product other than a computer
- There will encounter a number of difficulties when writing embedded system software in addition to those we encounter when we write applications

- **Throughput** – Our system may need to handle a lot of data in a short period of time.
- **Response**–Our system may need to react to events quickly
- **Testability**–Setting up equipment to test embedded software can be difficult
- **Debugability**–Without a screen or a keyboard, finding out what the software is doing wrong (other than not working) is a troublesome problem
- **Reliability** – embedded systems must be able to handle any situation without human intervention
- **Memory space** – Memory is limited on embedded systems, and you must make the software and the data fit into whatever memory exists
- **Program installation** – you will need special tools to get your software into embedded systems
- **Power consumption** – Portable systems must run on battery power, and the software in these systems must conserve power
- **Processor hogs** – computing that requires large amounts of CPU time can complicate the response problem
- **Cost** – Reducing the cost of the hardware is a concern in many embedded system projects; software often operates on hardware that is barely adequate for the job.

1.3.5. Application

1. Military and aerospace embedded software applications

2. Communication Application

1.4. LANGUAGES USED FOR CODING

- C
- C++
- Java
- Linux
- Assembly

1.4.1. MPLAB Features

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PIC® and dsPIC® microcontrollers.

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PIC® and dsPIC® microcontrollers.

MPLAB IDE runs as a 32-bit application on MS Windows®, is easy to use and includes a host of free software components for fast application development and super-charged debugging.

MPLAB IDE also serves as a single, unified graphical user interface for additional Microchip and third party software and hardware development tools. Moving between tools is a snap, and upgrading from the free software simulator to hardware debug and programming tools is done in a flash because MPLAB IDE has the same user interface for all tools.

MPLAB IDE's SIM, high speed software simulator for PIC and dsPIC (Digital Signal Processing PIC Microcontroller) devices with peripheral simulation, complex stimulus injection and register logging

CHAPTER 2

BLOCK DIAGRAM AND DESCRIPTION

2.1 BLOCK DIAGRAM

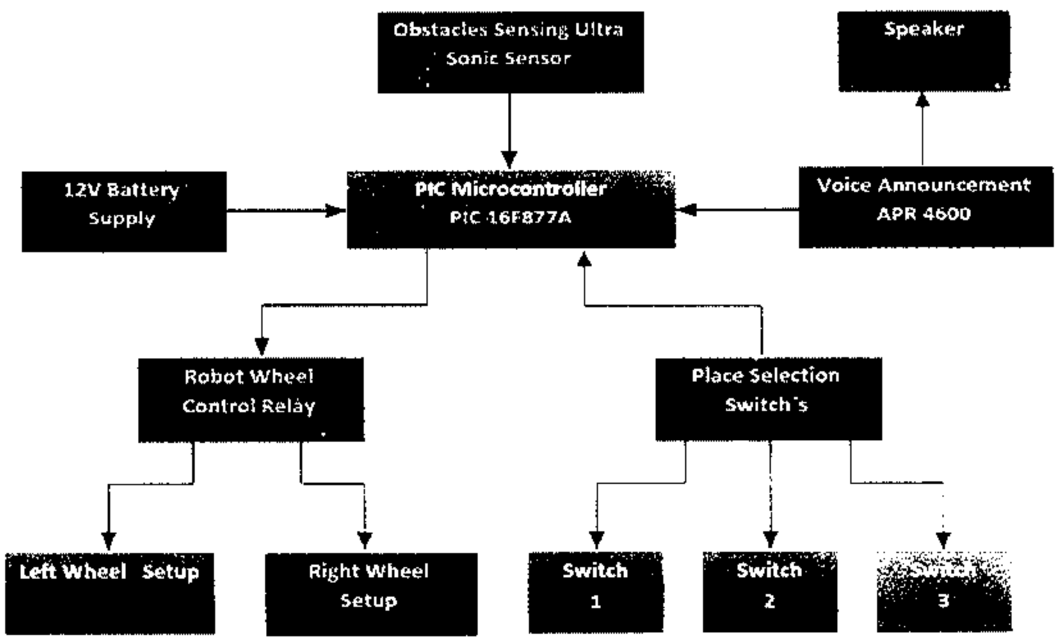


Fig 2.1 Block diagram

2.2. DESCRIPTION OF THE BLOCK DIAGRAM

The major components of this project are PIC Microcontroller, voice IC and ultra sonic sensors, relay and motor and

2.2.1. Power supply

The entire Project needs power for its operation. However, from the study of this project it comes to know that we supposed to design 5v and 12v dc power supply. So by utilizing the following power supply components, required power has been gained. (230/12v (1A and 500mA) – Step down transformers, Bridge rectifier to converter ac to dc, booster capacitor and +5v (7805) and +12v (7812) regulator to maintain constant 5v & 12 supply for the controller circuit and driver unit respectively).

2.2.2. PIC Microcontroller

The major heart of this project is PIC16F877A microcontroller, it has more features like 16bit timer, 10-bit ADC, USART, SPI, I2C, 256 bytes of EEPROM memory, and 8kbytes of flash program memory, then at last its speed of program execution is about to 1 microsecond or 10 MIPS (10 Million Instructions per second), etc. However, compare to other microcontroller it is fast and very ease to program in C language because of huge support can gain from the manufacturer (Microchip Corporation)for programming. The special IDE offered by the manufacture, it is named as MPLAB IDE for it code generation purpose. Then one more thing is several cheapest programming tools to dump the coding in to the controller are available, for example: ProPIC, PIC Flash, ProMATE, and ProUniversal.

2.2.3. VOICE IC

The APR9600 device offers true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, microphone amplifier, and AGC circuits greatly simplify system design. Where each memory cell can store 256 voltage levels. This technology enables the APR9600 device to reproduce voice signals in their natural form. It eliminates the need for encoding and compression, which often introduce distortion.

APR9600 IC for voice recording and playback. We can record voice by enabling record switch. We can store voice up to one minute. We can playback the voice with playback switch.

2.2.4. ULTRASONIC SENSOR

The Ultrasonic sensor will generate 40 kHz frequency with the help of inbuilt PWM in PIC16f72. If the signal hit any object within one meter it will be reflected and received at the receiver in the same board.

2.2.5. LCD Display

More microcontroller devices are using 'smart LCD' displays to output visual information. The following discussion covers the connection of a Hitachi LCD display to a PIC microcontroller. LCD displays designed around Hitachi's LCD HD44780 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 8 x 80 pixels of the display. Hitachi LCD displays have a standard ASCII set of characters plus Japanese, Greek and mathematical symbols.

CHAPTER 3

CIRCUIT DIAGRAM AND OPERATION

3.1. CIRCUIT DIAGRAM

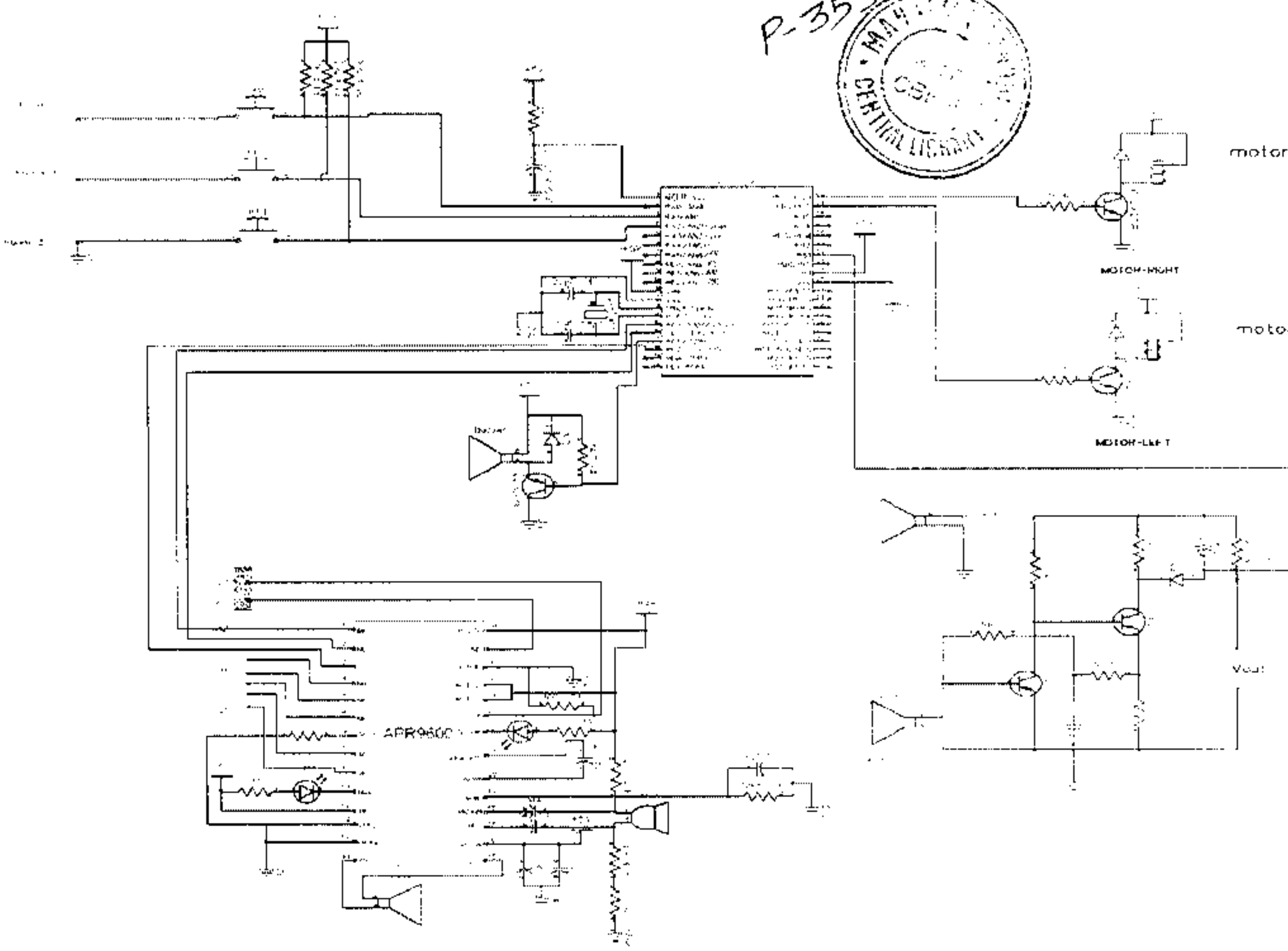


Fig 3.1 Circuit diagram

3.2. CIRCUIT OPERATION

3.2.1. POWERSUPPLY

In the transformer section affording Ac 230V.The output of the transformer is 12v.The Bridge circuit is connected across the transformer. The Rectified output is filtered with a 1000µf capacitor. Another capacitor is connected across the Filter for charging and discharging. The Regulator IC 7805 regulates the voltage to 5v. The first pin of the IC 7805 is connected to input, the second pin is grounded and the output is taken from the third pin.

3.2.2. LCD MODULE

The LCD module is connected to the PORTD. The Pins used are Register select, Read/write, Enable, D4, D5, D6 and D7.The Pins D4, D5, D6 and D7 are used for data transfer.

3.2.3. CRYSTAL OSCILLATOR.

The 4Hz Crystal Oscillator which is connected to the pins 11 and 12. Two 22pf capacitors are used across the Crystal Oscillator and are grounded.

3.2.4. RESET SWITCH

The Reset Switch is connected to the MCLR pin. When the switch is released after a key press, as it has the built in function of power on reset, the rising edge is taken as the condition for reset.

3.2.5. VOICE IC.

APR9600 IC for voice recording and playback. We can record voice by enabling record switch. We can store voice up to one minute. We can playback the voice with playback switch.

3.2.6. ULTRASONIC SENSOR

The Ultrasonic sensor will generate 40 kHz frequency with the help of inbuilt PWM in PIC16f72. If the signal hit any object within one meter it will be reflected and received at the receiver in the same board.

3.2.7. WORKING PRINCIPLE OF CIRCUIT

The MCU which is used in this project is PIC16f877A. We are giving an External Crystal Oscillator of 4MHz, since it will operate in the frequency of 1MHz. The MCU controls the input and output devices connected to it. We can store voice up to one minute in voice recordable IC. We can playback that voice by enabling playback switch. The MCU is programmed with a route map, the Robot identifies the place when it reaches and it will inform the Blind man by voice. The Robot has an Ultrasonic sensor, it can detect any object in its path, and if any object is detected it will automatically change the path.

CHAPTER 4

HARDWARE REQUIREMENTS:

1. Microcontroller PIC16F877A
2. Power Supply
3. Voice IC
4. Ultrasonic Sensors
5. LCD
6. Relay

4.1 PIC MICROCONTROLLER

4.1.1. MICROCONTROLLER PIC16F877A

Microcontroller Core Features:

• High-performance RISC CPU.

• Only 35 single word instructions to learn.

• All single cycle instructions except for program branches which are two cycle.

• Operating speed: DC - 20 MHz clock input DC - 200 ns instruction cycle.

• Up to 8K x 14 words of FLASH Program Memory, Up to 368 x 8 bytes of Data Memory (RAM) Up to 256 x 8 bytes of EEPROM data memory.

• Pin out compatible to the PIC16C73B/74B/76/77

- Interrupt capability (up to 14 sources)
- Eight level deep hardware stack
- Direct, indirect and relative addressing modes.
- Power-on Reset (POR).
- Power-up Timer (PWRT) and Oscillator Start-up Timer (OST).
- Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation.
- Programmable code-protection.
- Power saving SLEEP mode.
- Selectable oscillator options.
- Low-power, high-speed CMOS FLASH/EEPROM technology.
- Fully static design.
- In-Circuit Serial Programming (ICSP).
- Single 5V In-Circuit Serial Programming capability.
- In-Circuit Debugging via two pins.
- Wide operating voltage range: 2.0V to 5.5V.
- High Sink/Source Current: 25 mA.
- Commercial and Industrial temperature ranges.
- Low-power consumption.

- < 2 mA typical @ 5V, 4 MHz

- 20 µA typical @ 3V, 32 kHz

- < 1 µA typical standby current

4.1.2. PIN DIAGRAM OF PIC 16F874A/877A

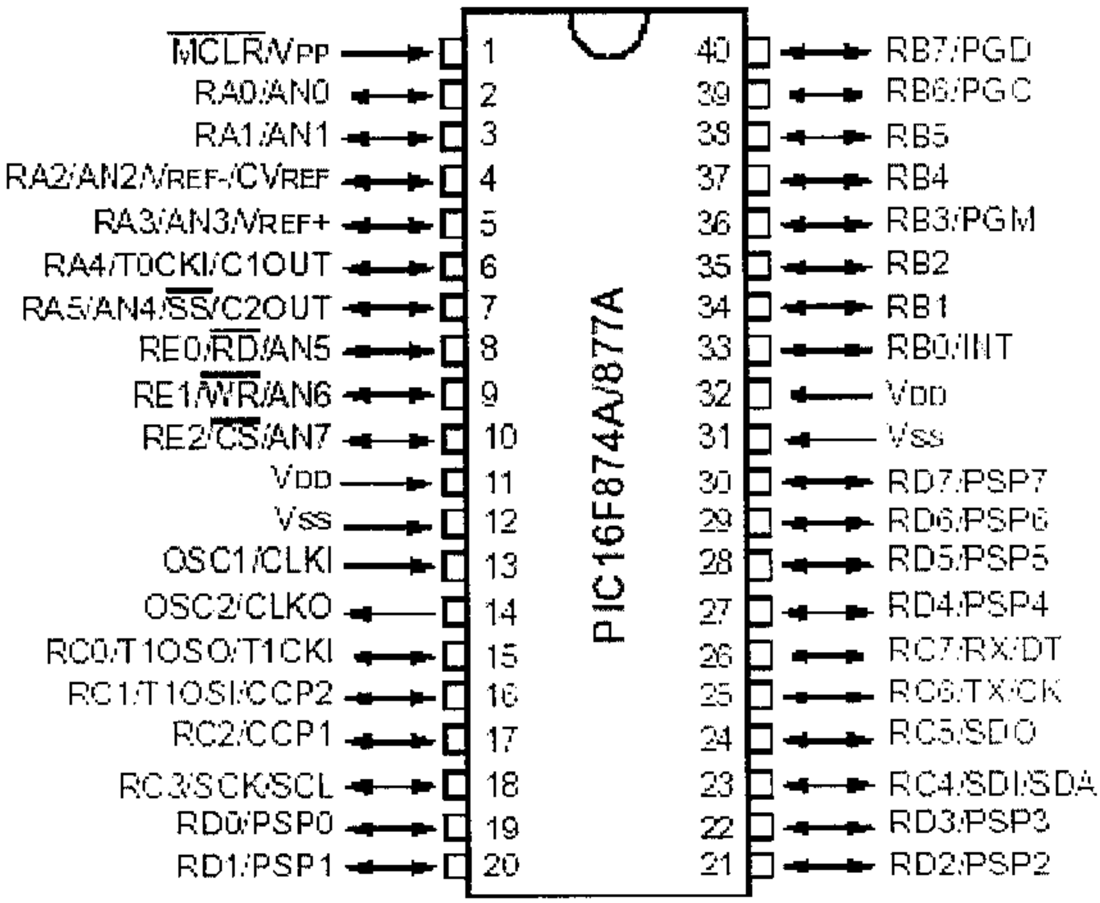


Fig 4.1 Pin diagram of PIC 16F877A

4.1.3. PERIPHERAL FEATURES

• **Timer0**: 8-bit timer/counter with 8-bit prescaler

• **Timer1**: 16-bit timer/counter with prescaler, can be incremented during sleep via external crystal/clock

• **Timer2:** 8-bit timer/counter with 8-bit period register, prescaler and postscaler

• Two Capture, Compare, PWM modules

- Capture is 16-bit, max. Resolution is 12.5 ns

- Compare is 16-bit, max. Resolution is 200 ns

- PWM max. Resolution is 10-bit

• 10-bit multi-channel Analog-to-Digital converter

• Synchronous Serial Port (SSP) with SPI (Master Mode) and I2C (Master/Slave)

• Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection

• Parallel Slave Port (PSP) 8-bits wide, with external RD, WR and CS controls (40/44-pin only)

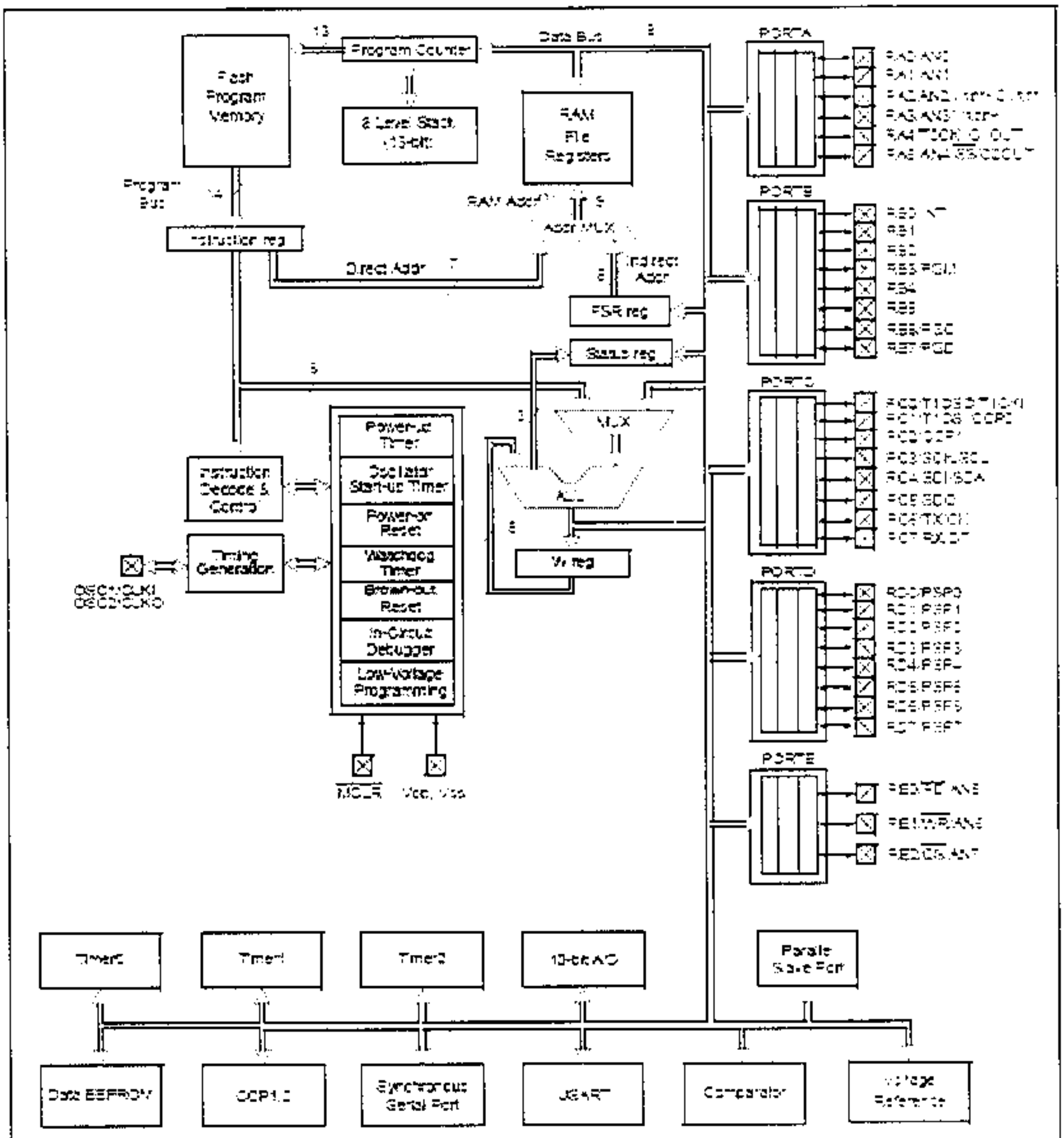
• Brown-out detection circuitry for Brown-out Reset (BOR)

4.1.4. CMOS TECHNOLOGY

• Low-power, high-speed Flash/EEPROM technology.

- Fully static design.
- Wide operating voltage range (2.0V to 5.5V).
- Commercial and Industrial temperature ranges.
- Low-power consumption.

4.1.5.ARCHITECTURE



Device	Program Flash	Data Memory	Data EEPROM
PIC16F874A	4K words	192 Bytes	128 Bytes
PIC16F877A	8K words	368 Bytes	256 Bytes

Fig4.2Architecture of PIC

4.1.6. PIN DESCRIPTION

OSC1/CLKI

Oscillator crystal or external clock input. Oscillator crystal input or external clock source input. ST buffer when configured in RC mode; otherwise CMOS. External clock source input. Always associated with pin function OSC1 (see OSC1/CLKI, OSC2/CLKO pins).

OSC2/CLKO

Oscillator crystal or clock output. Oscillator crystal output. Connects to The crystal or resonator in Crystal Oscillator mode. In RC mode, OSC2 pin outputs CLKO, which has 1/4 the frequency of OSC1 and denotes the instruction cycle rate.

I/O PORTS

Some pins for these I/O ports are multiplexed with an alternate function for the peripheral features on the device. In general, when a peripheral is enabled, that pin may not be used as a general purpose I/O pin.

PORTA AND TRISA REGISTER

PORTA is a 6-bit wide, bidirectional port. The corresponding data direction register is TRISA. Setting a TRISA bit (= 1) will make the corresponding PORTA pin an input (i.e., put the corresponding output driver in a High – Impedance mode). Clearing a TRISA bit (= 0) will make the corresponding PORTA pin an output (i.e., put the contents of the output latch on the selected pin). Reading the PORTA register reads the status of the pins, whereas writing to it will write to the port latch. All write operations are read-modify-write operations. Therefore, a write to a port implies that the port pins are read; the value is modified and then written to the port data latch.

Pin RA4 is multiplexed with the Timer0 module clock input to become the RA4/T0CKI pin. The RA4/T0CKI pin is a Schmitt Trigger input and an open-drain output. All other PORTA pins have TTL input levels and full CMOS output drivers. Other PORTA pins are multiplexed with analog inputs and the analog VREF input for both the A/D converters and the comparators. The operation of each pin is selected by clearing/setting the appropriate control bits in the ADCON1 and/or CMCON registers. The TRISA register controls the direction of the port pins even when they are being used as analog inputs. The user must ensure the bits in the TRISA register are maintained set when using them as analog inputs.

Note: On a Power-on Reset, these pins are configured as analog inputs and read as '0'. The comparators are in the off (digital).

PORT B AND TRISB REGISTER

PORTB is an 8-bit wide, bidirectional port. The corresponding data direction register is TRISB. Setting a TRISB bit (= 1) will make the corresponding PORTB pin an input (i.e., put the corresponding output driver in a High-Impedance mode). Clearing a TRISB bit (= 0) will make the corresponding PORTB pin an output (i.e., put the contents of the output latch on the selected pin). Three pins of PORTB are multiplexed with the In-Circuit Debugger and Low-Voltage Programming function: RB3/PGM, RB6/PGC and RB7/PGD.

Four of the PORTB pins, RB7:RB4, have an interruption- change feature. Only pins configured as inputs can cause this interrupt to occur (i.e., any RB7:RB4 pin configured as an output is excluded from the interruption- change comparison). The input pins (of RB7:RB4) are compared with the old value latched on the last read of PORTB. The "mismatch" outputs of RB7:RB4 are OR'ed together to generate the RB port change interrupt with flag bit RBIF (INTCON<0>).

This interrupt can wake the device from Sleep. The user, in the Interrupt Service Routine, can clear the interrupt in the following manner:

a) Any read or write of PORTB. This will end the mismatch condition.

b) Clear flag bit RBIF.

A mismatch condition will continue to set flag bit RBIF. Reading PORTB will end the mismatch condition and allow flag bit RBIF to be cleared. The interrupt-on-change feature is recommended for wake-up on key depression operation and operations where PORTB is only used for the interrupt-on-change feature.

Polling of PORTB is not recommended while using the interrupt-on- change feature. This interrupt-on-mismatch feature, together with software configurable pull-ups on these four pins, allow easy interface to a keypad and make it possible for wake-up on key depression.

PORTC AND TRISC REGISTER

PORTC is an 8-bit wide, bidirectional port. The corresponding data direction register is TRISC. Setting a TRISC bit (= 1) will make the corresponding PORTC pin an input (i.e., put the corresponding output driver in a High- Impedance mode). Clearing a TRISC bit (= 0) will make the corresponding PORTC pin an output (i.e., put the contents of the output latch on the selected pin). PORTC is multiplexed with several peripheral functions (Table 4-5). PORTC pins have Schmitt Trigger input buffers. When the I2C module is enabled, the PORTC<4:3> pins can be configured with normal I2C levels, or with SMBus levels, by using the

CKE bit (SSPSTAT<6>). When enabling peripheral functions, care should be taken in defining TRIS bits for each PORTC pin. Some peripherals override the TRIS bit to make a pin an output, while other peripherals override the TRIS bit to make a pin an input. Since the TRIS bit override is in effect while the peripheral is enabled, read-modify write instructions (BSF, BCF, XORWF) with TRISC as the destination, should be avoided. The user should refer to the corresponding peripheral section for the correct TRIS bit settings.

PORTD AND TRISD REGISTERS

PORTD is an 8-bit port with Schmitt Trigger input buffers. Each pin is individually configurable as an input or output. PORTD can be configured as an 8-bit wide microprocessor port (Parallel Slave Port) by setting control bit, PSP MODE (TRISE<4>). In this mode, the input buffers are TTL.

PORTE AND TRISE REGISTER

PORTE has three pins (RE0/RD/AN5, RE1/WR/AN6 and RE2/CS/AN7) which are individually configurable as inputs or outputs. These pins have Schmitt Trigger input buffers. The PORTE pins become the I/O control inputs for the microprocessor port when bit PSPMODE (TRISE<4>) is set. In this mode, the user must make certain that the TRISE<2:0> bits are set and that the pins are configured as digital inputs. Also, ensure that ADCON1 is configured for digital I/O. In this mode, the input buffers are TTL. Register 4-1 shows the TRISE register which also controls the Parallel Slave Port operation. PORTE pins are multiplexed with analog inputs.

When selected for analog input, these pins will read as '0's. TRISE controls. The direction of the RE pins, even when they are being used as analog inputs. The user must make sure to keep the pins configured as inputs when using them as analog inputs.

4.1.7 MEMORY ORGANIZATION

There are three memory blocks in each of the PIC16F87XA devices. The program memory and data memory have separate buses so that concurrent access can occur and is detailed in this section. The EEPROM data memory block is detailed in.

PROGRAM MEMORY ORGANIZATION

The PIC16F87XA devices have a 13-bit program counter capable of addressing an 8K word x 14 bit program memory space. The PIC16F876A/877A devices have 8K words x 14 bits of Flash program memory, while PIC16F873A/874A devices have 4K words x 14 bits. Accessing a location above the physically implemented address will cause a wraparound. The Reset vector is at 0000h and the interrupt vector is at 0004h.

The data memory is partitioned into multiple banks which contain the General Purpose Registers and the Special Function Registers. Bits RP1 (Status<6>) and RP0 (Status<5>) are the bank select bits. Each bank extends up to 7Fh (128 bytes). The lower locations of each bank are reserved for the Special Function Registers. Above the Special Function Registers are General Purpose Registers, implemented as static RAM. All implemented banks contain Special Function Registers. Some frequently used Special Function Registers from one bank may be mirrored in another bank for code reduction and quicker access.

IN-CIRCUIT DEBUGGER

PIC16F87XA devices have a Watchdog Timer which can be shut-off only through configuration bits. It runs off its own RC oscillator for added reliability. There are two timers that offer necessary delays on power-up. One is the Oscillator Start-up Timer (OST), intended to keep the chip in Reset until the crystal oscillator is stable. The other is the Power-up Timer (PWRT), which provides a fixed delay of 72 ms (nominal) on power-up only. It is designed to keep the part

In Reset while the power supply stabilizes. With these two timers on-chip, most applications need no external Reset circuitry. Sleep mode is designed to offer a very low current power-down mode. The user can wake-up from Sleep through external Reset, Watchdog Timer wake-up or through an interrupt. Several oscillator options are also made available to allow the part to fit the application. Th

4.2 POWER SUPPLY UNIT

4.2.1 CIRCUIT DIAGRAM

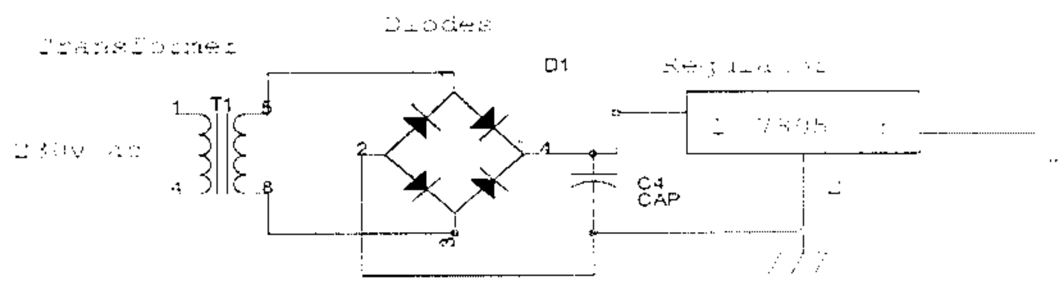


Fig 4.3 Power supply unit

Power supply unit consists of following units

i) Step down transformer

ii) Rectifier unit

iii) Input filter

iv) Regulator unit

v) Output filter

4.2.2 STEP DOWN TRANSFORMER

The Step down Transformer is used to step down the main supply voltage from 230V AC to lower value. This 230 AC voltage cannot be used directly, thus it is stepped down. The Transformer consists of primary and secondary coils. To reduce or step down the voltage, the transformer is designed to contain less number of turns in its secondary core. The output from the secondary coil is also AC waveform. Thus the conversion from AC to DC is essential. This conversion is achieved by using the Rectifier Circuit/Unit.

Step down transformers can step down incoming voltage, which enables you to have the correct voltage input for your electrical needs. For example, if our equipment has been specified for input voltage of 12 volts, and the main power supply is 230 volts, we will need a step down transformer, which decreases the incoming electrical voltage to be compatible with your 12 volt equipment.

4.2.3 RECTIFIER UNIT

The Rectifier circuit is used to convert the AC voltage into its corresponding DC voltage. The most important and simple device used in Rectifier circuit is the diode. The simple function of the diode is to conduct when forward biased and not to conduct in reverse bias. Now we are using three types of rectifiers. They are

1. Half-wave rectifier

2. Full-wave rectifier
3. Bridge rectifier

The bridge rectifier is used

4.2.3.1 BRIDGE RECTIFIER

A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

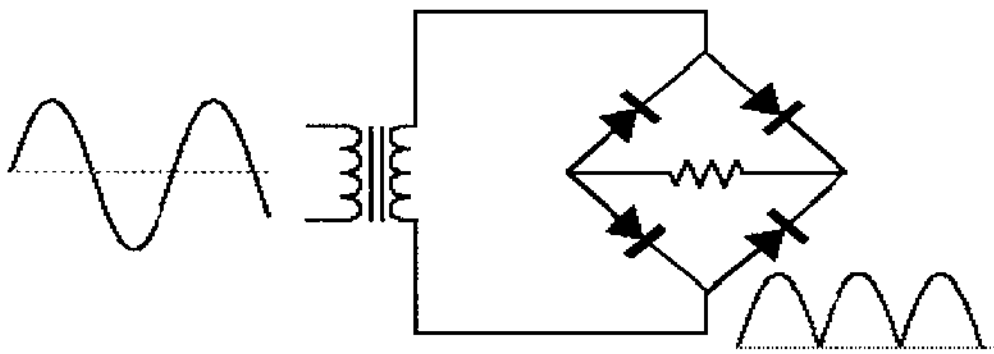


Fig 4.4 Bridge rectifier

A **diode bridge** or **bridge rectifier** is an arrangement of four diodes in a bridge configuration that provides the same polarity of output voltage for either polarity of input voltage. When used in its most common application, for conversion of alternating current (AC) input into direct current (DC) output, it is known as a bridge rectifier. A bridge rectifier provides full-wave rectification from a two-wire AC input, resulting in lower cost and weight as compared to a center-tapped transformer design.

The Forward Bias is achieved by connecting the diode's positive with positive of the battery and negative with battery's negative. The efficient circuit used is the Full wave Bridge rectifier circuit. The output voltage of the rectifier is in rippled form, the ripples from the obtained DC voltage are removed using other circuits available. The circuit used for removing the ripples is called Filter circuit.

4.2.4 INPUT FILTER

Capacitors are used as filter. The ripples from the DC voltage are removed and pure DC voltage is obtained. And also these capacitors are used to reduce the harmonics of the input voltage. The primary action performed by capacitor is charging and discharging. It charges in positive half cycle of the AC voltage and it will discharge in negative half cycle. So it allows only AC voltage and does not allow the DC voltage. This filter is fixed before the regulator. Thus the output is free from ripples.

There are two types of filters. They are

1. Low pass filter
2. High pass filter

4.2.5 REGULATOR UNIT

Fig 4.5 7805 Regulator

Regulator regulates the output voltage to be always constant. The output voltage is maintained irrespective of the fluctuations in the input AC voltage. As and then the AC voltage changes, the DC voltage also changes. Thus to avoid this Regulators are used. Also when the internal resistance of the power supply is greater than 30 ohms, the output gets affected. Thus this can be successfully reduced here. The regulators are mainly classified for low voltage and for high voltage. Further they can also be classified as:

i) Positive regulator

1---> input pin

2---> ground pin

3---> output pin

It regulates the positive voltage.

ii) Negative regulator

1---> ground pin

2---> input pin

3---> output pin

It regulates the negative voltage.

4.2.5.1 FIXED REGULATORS

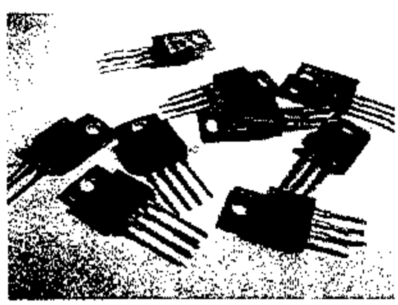


Fig 4.6 An assortment of 78xx series ICs

"Fixed" three-terminal linear regulators are commonly available to generate fixed voltages of plus 3 V, and plus or minus 5 V, 9 V, 12 V, or 15 V when the load is less than about 7 **amperes.**

7805 Voltage regulator:

The 7805 provides circuit designers with an easy way to regulate DC voltages to 5v. Encapsulated in a single chip/package (IC), the 7805 is a positive voltage DC regulator that has only 3 terminals. They are: Input voltage, Ground, Output Voltage.

General Features:

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection

7812 12V Integrated Circuit3-Terminal Positive Voltage Regulator:

The 7812 fixed voltage regulator is a monolithic integrated circuit in a TO220 type package designed for use in a wide variety of applications including local, onboard regulation. This regulator employs internal current limiting, thermal shutdown, and safe area compensation.

With adequate heat-sinking it can deliver output currents in excess of 1.0 ampere. Although designed primarily as a fixed voltage regulator, this device can be used with external components to obtain adjustable voltages and currents.

4.3 LCD DISPLAY

Liquid crystal display (LCD) has material which combines the properties of both liquid and crystals. They have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an order form similar to a crystal.

LCD display

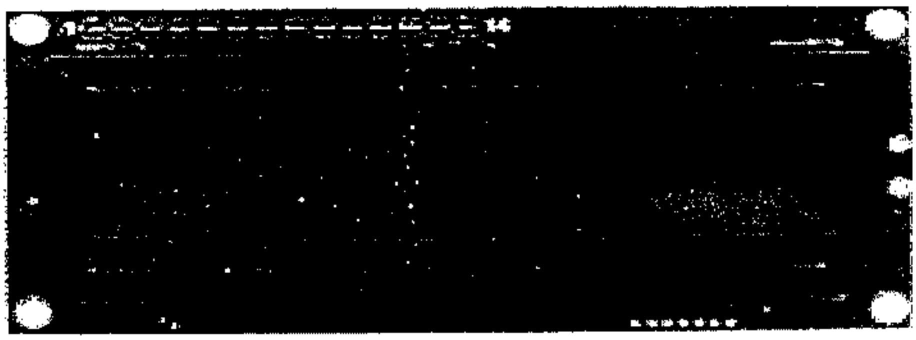


Fig 4.7 LCD display

More microcontroller devices are using 'smart LCD' displays to output visual information. The following discussion covers the connection of a Hitachi LCD display to a PIC microcontroller. LCD displays designed around Hitachi's LCD HD44780 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 8 x 80 pixels of the display. Hitachi LCD displays have a standard ASCII set of characters plus Japanese, Greek and mathematical symbols.

For an 8-bit data bus, the display requires a +5V supply plus 11 I/O lines. For a 4-bit data bus it only requires the supply lines plus seven extra lines. When the LCD display is not enabled, data lines are tri-state which means they are in a state of high impedance (as though they are disconnected) and this means they do not interfere with the operation of the microcontroller when the display is not being addressed.

The LCD also requires 3 "control" lines from the microcontroller.

Enable (E) This line allows access to the display through R/W and RS lines.

	When this line is low, the LCD is disabled and ignores signals from R/W and RS. When (E) line is high, the LCD checks the state of the two control lines and responds accordingly.
Read/Write (R/W)	This line determines the direction of data between the LCD and microcontroller. When it is low, data is written to the LCD. When it is high, data is read from the LCD.
Register select (RS)	With the help of this line, the LCD interprets the type of data on data lines. When it is low, an instruction is being written to the LCD. When it is high, a character is being written to the LCD.

Logic status on control lines:

E 0 Access to LCD disabled

1 Access to LCD enabled

R/W 0 Writing data to LCD

1 Reading data from LCD

RS 0 Instruction

1 Character

Writing data to the LCD is done in several steps:

Set R/W bit to low

Set RS bit to logic 0 or 1 (instruction or character)

Set data to data lines (if it is writing)

Set E line to high

Set E line to low

Read data from data lines (if it is reading).

Reading data from the LCD is done in the same way, but control line R/W has to be high. When we send a high to the LCD, it will reset and wait for instructions. Typical instructions sent to LCD display after a reset are: turning on a display, turning on a cursor and writing characters from left to right. When the LCD is initialized, it is ready to continue receiving data or instructions. If it receives a character, it will write it on the display and move the cursor one space to the right. The Cursor marks the next location where a character will be written. When we want to write a string of characters, first we need to set up the starting address, and then send one character at a time. Characters that can be shown on the display are stored in data display (DD) RAM. The size of DDRAM is 80 bytes.

The LCD display also possesses 64 bytes of Character-Generator (CG) RAM. This memory is used for characters defined by the user. Data in CG RAM is represented as an 8-bit character bit-map. Each character takes up 8 bytes of CG RAM, so the total number of characters, which the user can define, is eight. In order to read in the character bit-map to the LCD display, we must first set the CG RAM address to starting point (usually 0), and then write data to the display.

At the beginning we mentioned that we needed 11 I/O lines to communicate with an LCD. However, we can communicate with an LCD through a 4-bit data bus. Thus we can reduce the total number of communication lines to seven.

4.4. VOICE IC

4.4.1. DESCRIPTION:

The APR9600 device offers true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, microphone amplifier, and AGC circuits greatly simplify system design. The device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications. PLUS integrated achieves these high levels of storage capability by using its proprietary analog/multilevel storage technology implemented in an advanced Flash non-volatile memory process, where each memory cell can store 256 voltage levels.

This technology enables the APR9600 device to reproduce voice signals in their natural form. It eliminates the need for encoding and compression, which often introduce distortion.

4.4.2FEATURES:

• Single-chip, high-quality voice recording & playback solution

- No external ICs required

- Minimum external components

• Non-volatile Flash memory technology

- No battery backup required

• User-Selectable messaging options

- Random access of multiple fixed-duration messages

- Sequential access of multiple variable-duration messages

• User-friendly, easy-to-use operation

- Programming & development systems not required

- Level-activated recording & edge-activated play back switches

• Low power consumption

- Operating current: 25 mA typical

- Standby current: 1 uA typical

- Automatic power-down

• Chip Enable pin for simple message expansion

4.4.3. PIN DIAGRAM

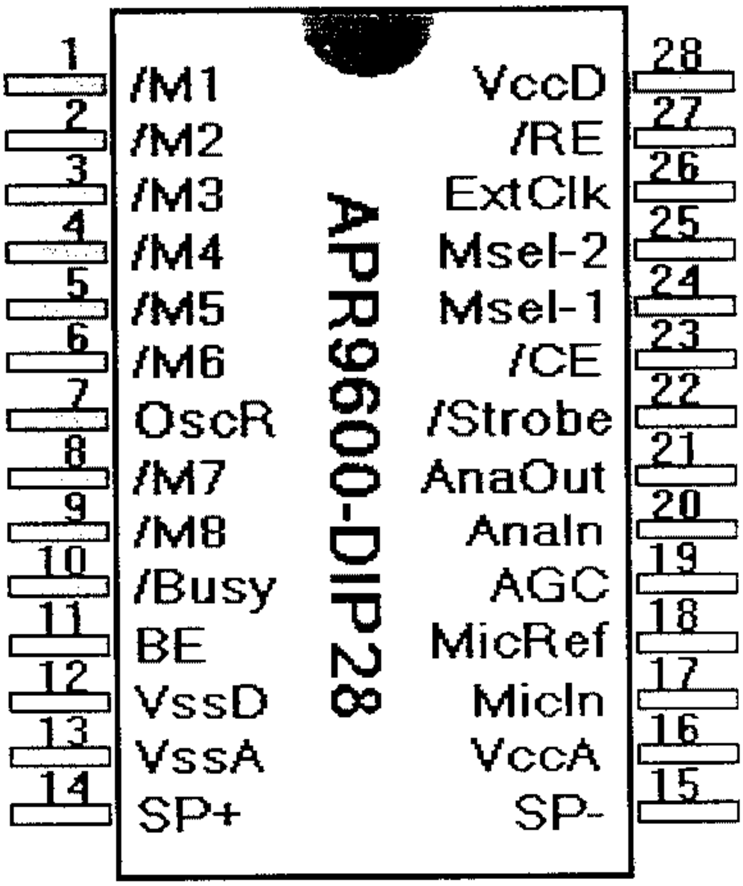


Fig 4.8 pin diagram

4.4.4. INTERNAL BLOCK DIAGRAM OF VOICE IC

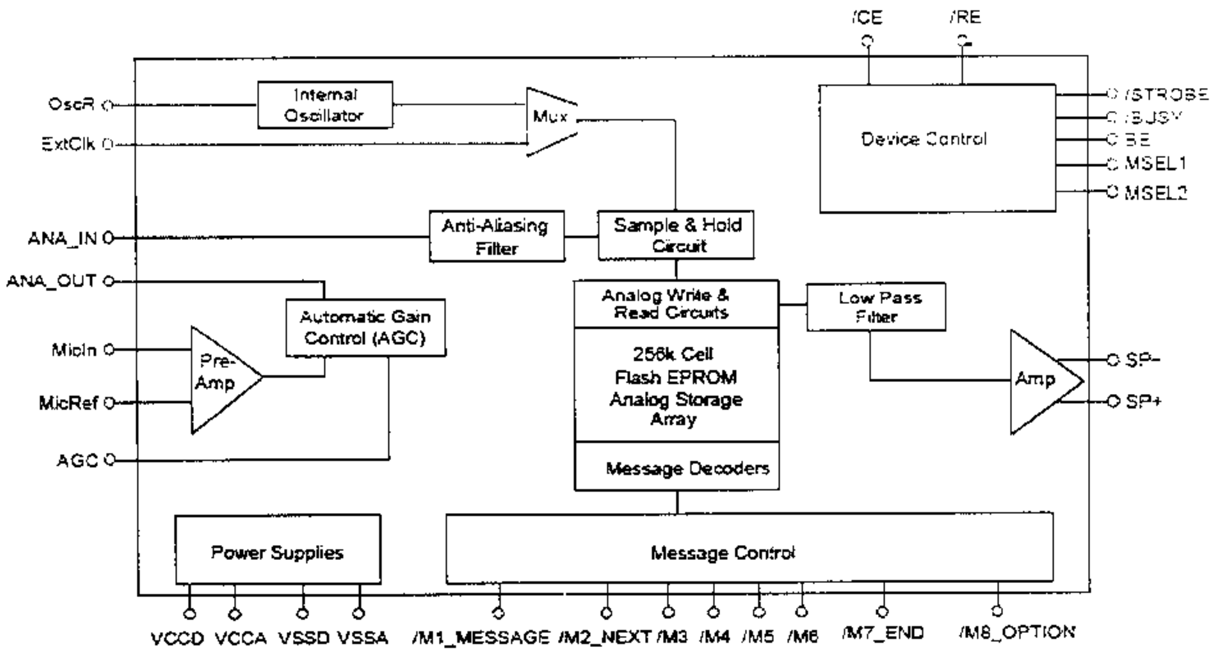


Fig 4.9 Internal block diagram

4.4.5. Message Management General Description

Playback and record operations are managed by on-chip circuitry. There are several available messaging modes depending upon desired operation. These message modes determine message management style, message length, and external parts count. Therefore, the designer must select the appropriate operating mode before beginning the design. Operating modes do not affect voice quality; for information on factors affecting quality refer to the Sampling Rate & Voice Quality section. The device supports five message management modes (defined by the MSEL1, MSEL2 and /M8_OPTION pins shown in Figures 1 and 2):

Random access mode with 2, 4, or 8 fixed-duration messages Tape mode, with multiple

Variable-duration messages, provides two options:

- Auto rewind

- Normal

Modes cannot be mixed. Switching of modes after the device has recorded an initial message is not recommended. If modes are switched after an initial recording has been made some unpredictable message fragments from the previous mode may remain present, and be audible on playback, in the new mode. These fragments will disappear after a Record operation in the newly selected mode. Table 1 defines the decoding necessary to choose the desired mode. An important feature of the APR9600 Message management capabilities is the ability to audibly prompt the user to change in the device's status through the use of "beeps" superimposed on the device's output. This feature is enabled by asserting a logic high level on the BE pin.

Mode MSEL1 MSEL2 /M8_OPTION

Random Access 2 fixed duration messages 0 1 Pull this pin to VCC through 100K resistor

Random Access 4 fixed duration messages 1 0 Pull this pin to VCC through 100K resistor

Random Access 8 fixed duration messages 1 1 The /M8 message trigger becomes input pin

Tape mode, Auto rewind operation 0 0 0

Tape mode, Normal operation 0 0 1

4.4.6RANDOM ACCESS MODE

Random access mode supports 2, 4, or 8 Message segments of fixed duration. As suggested recording or playback can be made randomly in any of the selected messages. The length of each message segment is the total recording length available (as defined by the selected sampling rate) divided by the total number of segments enabled (as decoded in Table1). Random access mode provides easy indexing to message segments.

4.4.6.1 A FUNCTIONAL DESCRIPTION OF RECORDING IN RANDOM ACCESS MODE

On power up, the device is ready to record or playback in any of the enabled message segments. To record,/CE must be set low to enable the device and /RE must be set low to enable recording. You initiate recording by applying a low level on the message trigger pin that represents the message segment you intend to use. The message trigger pins are labeled /M1_MESSAGE - /M8_OPTION on pins 1-9 (excluding pin 7) for message segments 1-8 respectively. Note: Message trigger pins of M1_MESSAGE,/M2_NEXT, /M7_END, and /M8_OPTION, have expanded names to represent the different functionality that these pins assume in the other modes. In random access mode these pins should be considered purely message trigger pins with the same functionality as /M3, /M4, /M5,and /M6. For a more thorough explanation of the functionality of device pins in different modes please refer to the pin description table that appears later in this document.

When actual recording begins the device responds with a single beep (if the BE pin is high to enable the beep tone) at the speaker outputs to indicate that it has started recording.

Recording continues as long as the message pin stays low. The rising edge of the same message trigger pin during record stops the recording operation (indicated with a single beep).If the message trigger pin is held low beyond the end of the maximum allocated duration, recording stops automatically (indicated with two beeps), regardless of the state of the message trigger pin. The chip then enters low-power mode until the message trigger pin returns high. After the message trigger pin returns to high, the chip enters standby mode. Any subsequent high to low transition on the same message trigger pin will initiate recording from the beginning of the same message segment. The entire previous message is then overwritten by the new message, regardless of the duration of the new message.

Transitions on any other message trigger pin or the /RE pin during the record operation are ignored until after the device enters standby mode.

4.4.6.2 FUNCTIONAL DESCRIPTION OF PLAYBACK RANDOM ACCESS MODE

On power up, the device is ready to record or playback, in any of the enabled message segments. To playback,/CE must be set low to enable the device and /RE must be set high to disable recording & enable playback. You initiate playback by applying a high to low edge on the message trigger pin that represents the message segment you intend to playback.

Playback will continue until the end of the message is reached. If a high to low edge occurs on the same message trigger pin during playback, playback of the current message stops immediately. If a different message trigger pin pulses during playback, playback of the current message stops immediately (indicated by one beep) and playback of the new message segment begins. A delay equal to 8,400 cycles of the sample clock will be encountered before the device starts playing the new message. If a message trigger pin is held low, the selected message is played back repeatedly as long as the trigger pin stays low. A period of silence, of duration equal to 8,400 cycles of the sampling clock, will be inserted during looping as an indicator to the user of the transition between the end and the beginning of the message.

4.5. RELAY

A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Relays are found hidden in all sorts of devices. A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts as shown in the diagram.

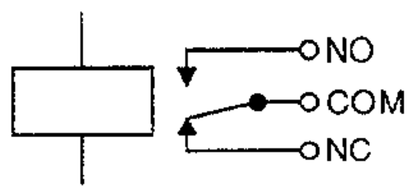


Fig 4.10 Relay

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

4.6. ULTRA SONIC SENSOR

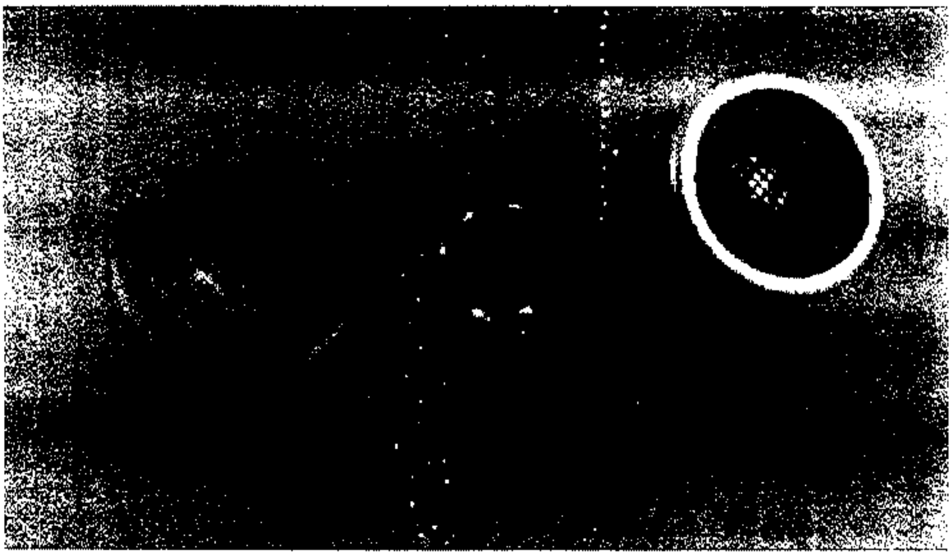


Fig 4.11 Ultrasonic sensor

The Ultrasonic sensor will generate 40 kHz frequency with the help of inbuilt PWM in PIC16f72. If the signal hit any object within one meter it will be reflected and received at the receiver in the same board.

4.6.1SPECIFICATION

- 400ST160 Transmitter
- 400SR160 Receiver
- Center Frequency 40.0±1.0Khz
- Bandwidth (-6dB) 400ST160 2.0Khz
- 400SR160 2.5Khz

- at 40.0Khz; 0dB re 0.0002μbar
- per 10Vrms at 30cm
- 120dB min.

Receiving Sensitivity

- at 40.0Khz 0dB = 1 volt/μbar
- -65dB min.

4.7. LOUDSPEAKER

A **loudspeaker** (or "speaker") is an electro acoustic transducer that produces sound in response to an electrical audio signal input.

Loudspeaker, also called Speaker, in sound reproduction, device for converting electrical energy into acoustical signal energy that is radiated into a room or open air. The term signal energy indicates that the electrical energy has a specific form, corresponding, for example, to speech, music, or any other signal in the range of audible frequencies (roughly 20 to 20,000 hertz). The loudspeaker should preserve the essential character of this signal energy in acoustical form. This definition of a loudspeaker excludes such devices as buzzers, gongs, and sirens, in which the acoustical signal energy does not correspond in form to the electrical signal. The part of the speaker that converts electrical into mechanical energy is frequently called the motor, or voice coil. The motor vibrates a diaphragm that in turn vibrates the air in immediate contact with it, producing a sound wave corresponding to the pattern of the original speech or music signal. Most frequently the motor consists of a coil of wire moving in a strong magnetic field, but the diaphragm may also be operated by electrostatic forces or by the action of a piezoelectric material.

5.5.1 COMPILER

A compiler is a program that reads a program in one language, the source language and translates into an equivalent program in another language, the target language. The translation process should also report the presence of errors in the source program.

Source Program ? Compiler ? Target Program

?

Error Messages

There are two parts of compilation. The analysis part breaks up the source program into constant piece and creates an intermediate representation of the source program. The synthesis part constructs the desired target program from the intermediate representation.

5.5.3 PHASES OF COMPILER

The compiler has a number of phases plus symbol table manager and an error handler.

Input Source
Program

?

Lexical
Analyzer

?

Syntax
Analyzer

?

Symbol
Table
Manager

Semantic
Analyzer

Error
Handler

?

Intermediate
Code
Generator

?

Code

Optimizer

?

Code

Generator

?

Out Target

Program

Fig 5.1 Phases of compiler

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