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INTELLIGENT TRACKER
An Automatic Emergency Indicator

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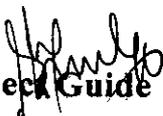
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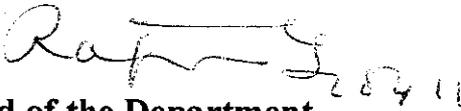
APRIL 2011

BONAFIDE CERTIFICATE

Certified that this project report entitled "INTELLIGENT TRACKER" is the bonafide work of Mr. V.NAVEEN KUMAR [Reg. no. 0710107063], Mr. M.SADANAND SAKTHIVEL [Reg. No. 0710107081] and Mr. M.T.VINOTH [Reg. no. 0710107114] 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.

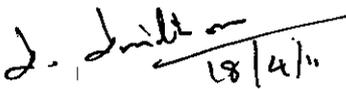

Project Guide

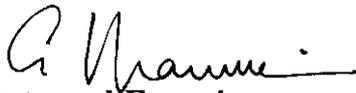
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ABSTRACT

This proposed project deals with giving intelligence to the security system. In this the human identity is carried out using sensors. The various parameters such as temperature and heart beat of the human beings are checked. The project is intended for tracking a human in a hazardous zone over a particular area and rescue at times of emergency. The overall control scheme is mainly governed by a PIC16F877A microcontroller. This whole system can be monitored through a LCD monitor. A temperature sensor and piezoelectric sensor is fitted with the human body as a tag. The sensors will sense the body temperature, vibrations of heart and compare those with reference value; if it exceeds the reference value then it triggers the GSM module. The GPS receiver receives the Longitudinal and latitudinal value. This information is transmitted through the GSM to a pre-stored number. The receiver (mobile phone) will receive a SMS from the GSM modem about the position of the human being automatically; with reference to the position the spot is located and the person is saved.

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LIST OF ABBREVIATIONS

GPS	-----	Global Positioning System
GSM	-----	Global System for Mobile
LCD	-----	Liquid Crystal Display
LED	-----	Light Emitting Diode
PCB	-----	Printed Circuit Board
PIC	-----	Peripheral Interface Controller
RISC	-----	Reduced Instruction Set Controller
RTS	-----	Real Time System
SIM	-----	Subscriber Identity Module
SMS	-----	Short Message Sending

CHAPTER 1

INTRODUCTION

1.1. INTRODUCTION

Many accidents which occur in which there would be nobody to inform the emergency services or rescue the victims which lead to many deaths. Therefore in order to rescue them an automatic accident indicator which detects the human parameters such as temperature and heart beat vibrations and inform the emergency services through SMS about the location of the accident automatically. The location is obtained by GPS receiver. This is an effective and low-cost method to save a number of lives. This is used for effective rescue operation in hazardous areas in case of accidents.

1.2. METHODOLOGY OF THE STUDY

Development of Intelligent tracker: An automatic accident detecting and tracking system is developed in embedded systems. The main purpose of this project is to alert the emergency services and reduce death during accidents.

1.3. INTRODUCTION TO EMBEDDED SYSTEMS

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

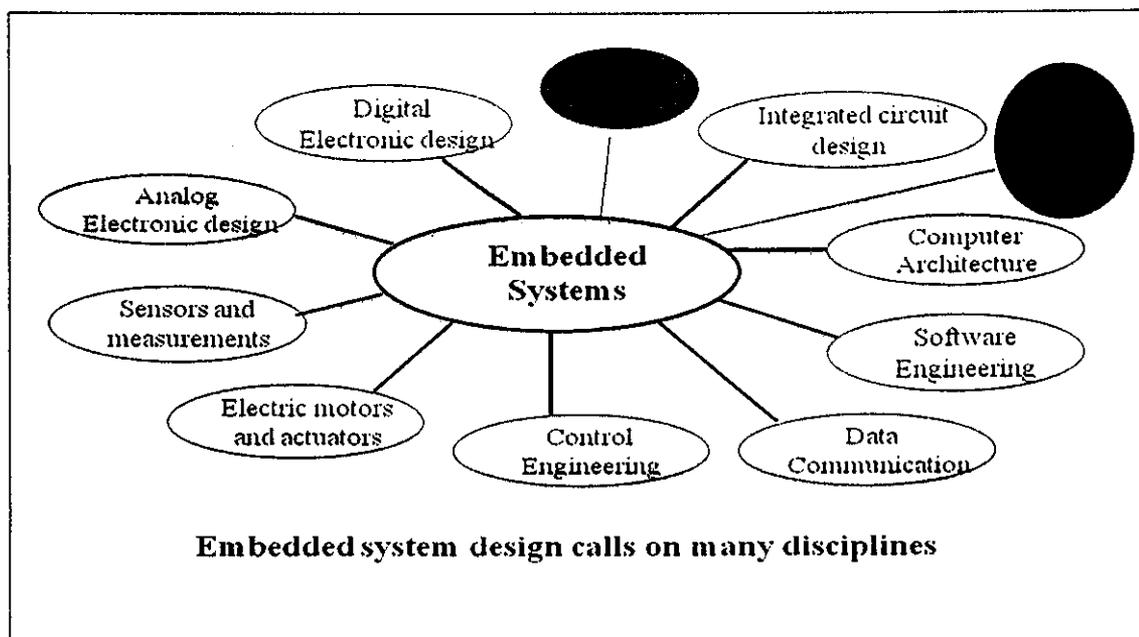


Fig 1.1 Embedded system design calls

1.3.3 .Embedded system design cycle

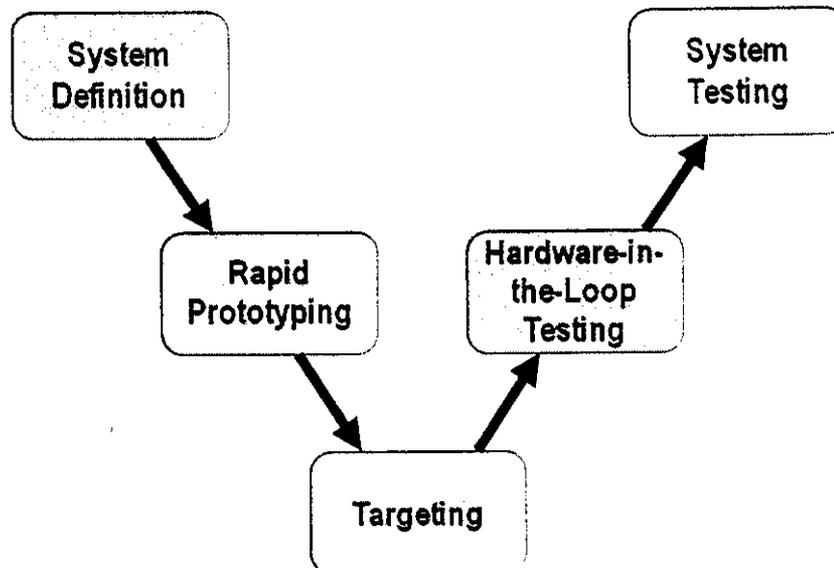


Fig 1.2 Embedded system design cycle

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 Applications.

3. Industrial automation and process control software.

1.3.6. Classification

- Real Time Systems.
- RTS is one which has to respond to events within a specified deadline.
- A right answer after the dead line is a wrong answer.

1.3.7. RTS Classification

- Hard Real Time System
- Soft Real Time System

1.3.8. Hard real time system

- “Hard” real-time systems have very narrow response time.
- Example: Nuclear power system, Cardiac pacemaker.

1.3.9. Soft real time system

- “Soft” real-time systems have reduced constrains on “lateness” but still must operate very quickly and repeatable.
- Example: Railway reservation system – takes a few extra seconds the data remains valid.

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.

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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

The major components of this project are PIC Microcontroller, Temperature, Light and Humidity sensors, Potential and Current transformer and load driver unit (i.e., for AC., plug point and TRIAC circuit).

Intelligent Tracker

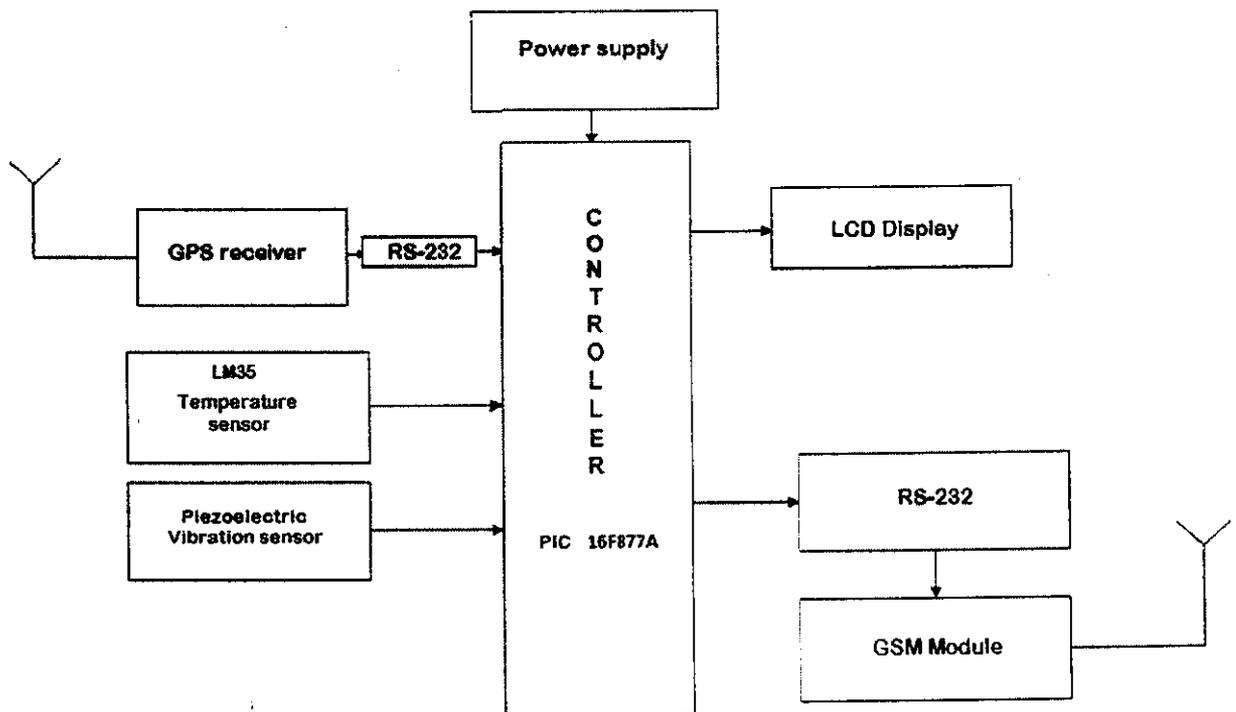


Fig 2.1 Block diagram

2.2. DESCRIPTION OF THE BLOCK DIAGRAM

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, the reasons why we selected this in our project?, 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. Precision Centigrade Temperature Sensors

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35

thus has an advantage over linear temperature sensors calibrated in° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4^{\circ}\text{C}$ at room temperature and $\pm 3/4^{\circ}\text{C}$ over a full -55 to $+150^{\circ}\text{C}$ temperature range.



2.2.4. Vibration Sensor

A **piezoelectric sensor** is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal. A piezoelectric transducer has very high DC output impedance and can be modeled as a proportional voltage source and filter network. The voltage at the source is directly proportional to the applied force, pressure, or strain. The output signal is then related to this mechanical force as if it had passed through the equivalent circuit.

2.2.5. RS 232

The RS232 cable which is used to connect the GPS and GSM module to the micro controller, these are connected by means of the MAX232. Since the RS232 is not compatible with today's microprocessors and micro controller, we need line driver to convert the RS232 signals to TTL voltage levels that will be acceptable to the controller's TXD and RXD pins which is done by MAX232.

2.2.6. S49 GPS Receiver

The GPS smart receiver features the 16 channels .Ultra low power GPS architecture. This complete enabled GPS receiver provides high position, velocity and time accuracy performances as well as high sensitivity and tracking capabilities. The ultra low power CMOS technology, the GPS receiver is ideal for

many portable applications such as PDA, Tablet PC, smart phone etc. The s49 processor is used in it.

2.2.7. Sim300 GSM Module

The Sim300 is a Tri-Brand GSM GPRS solution in a compact plug-in module.

Featuring an industry-standard interface, the sim300 delivers GSM GPRS 900 1800 1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. The leading features of Sim300 make it ideal for virtually unlimited application, such as WLL applications (Fixed Cellular Terminal), M2M application, handheld devices and much more.

2.2.8. LCD Display

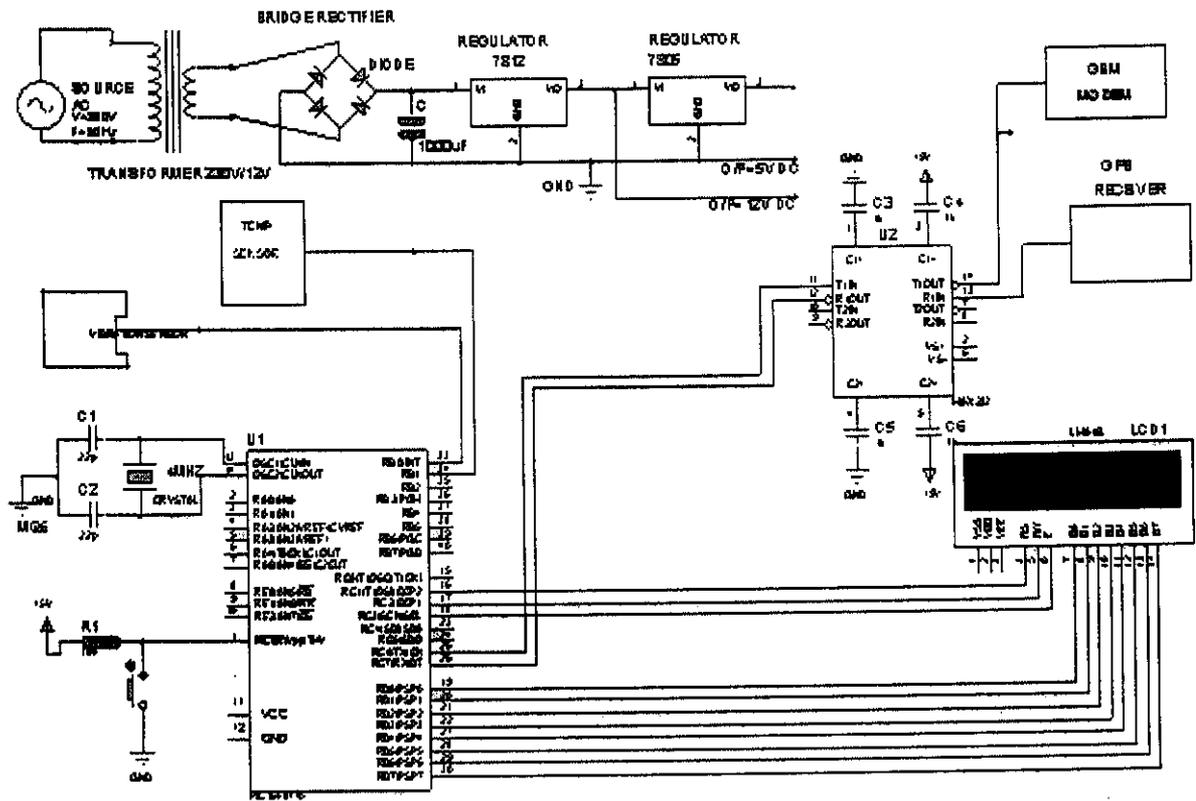
More microcontroller devices are using 'smart LCD' displays to output visual information. The following discussion covers the connection of a Hitachi LCD display to a PIC microcontroller. LCD displays designed around Hitachi's LCD HD44780 module, are inexpensive, easy to use, and it is even possible 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

The following figure represents the circuit diagram of the proposed project



3.2. CIRCUIT OPERATION

Power supply unit consists of Step down transformer, Rectifier, Input filter, Regulator unit, Output filter. 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. The Rectifier circuit is used to convert the AC voltage into its corresponding DC voltage. There are Half-Wave, Full-Wave and bridge Rectifiers available for this specific function. 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. 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. This filter is fixed before the regulator. Thus the output is free from ripples. Regulator regulates the output voltage to be always constant. The output voltage is maintained irrespective of the fluctuations in the input AC voltage.

The PIC 16f877A microcontroller is a 40-pin IC. The first pin of the controller is MCLR pin and the 5V dc supply is given to this pin through 10K Ω resistor. This supply is also given to 11th pin directly. The 12th pin of the controller is grounded. A tank circuit consists of a 4 MHz crystal oscillator and two 22pf capacitors are connected to 13th and 14th pins of the PIC.

The MAX232 IC connected with microcontroller and GSM, GPS modems, temperature sensor and vibration sensor output is given to controller ADC module.

If the body temperature or heart beat goes to abnormal (increase) condition automatically the controller receives the data's from GPS and send to GSM through RS232 communication with help of AT commands, now this GSM modem send the sms automatically to specified mobile number through network, from this sms easily they can identify the locations.

3.3. FLOW CHART

The following flow chart represents the program execution

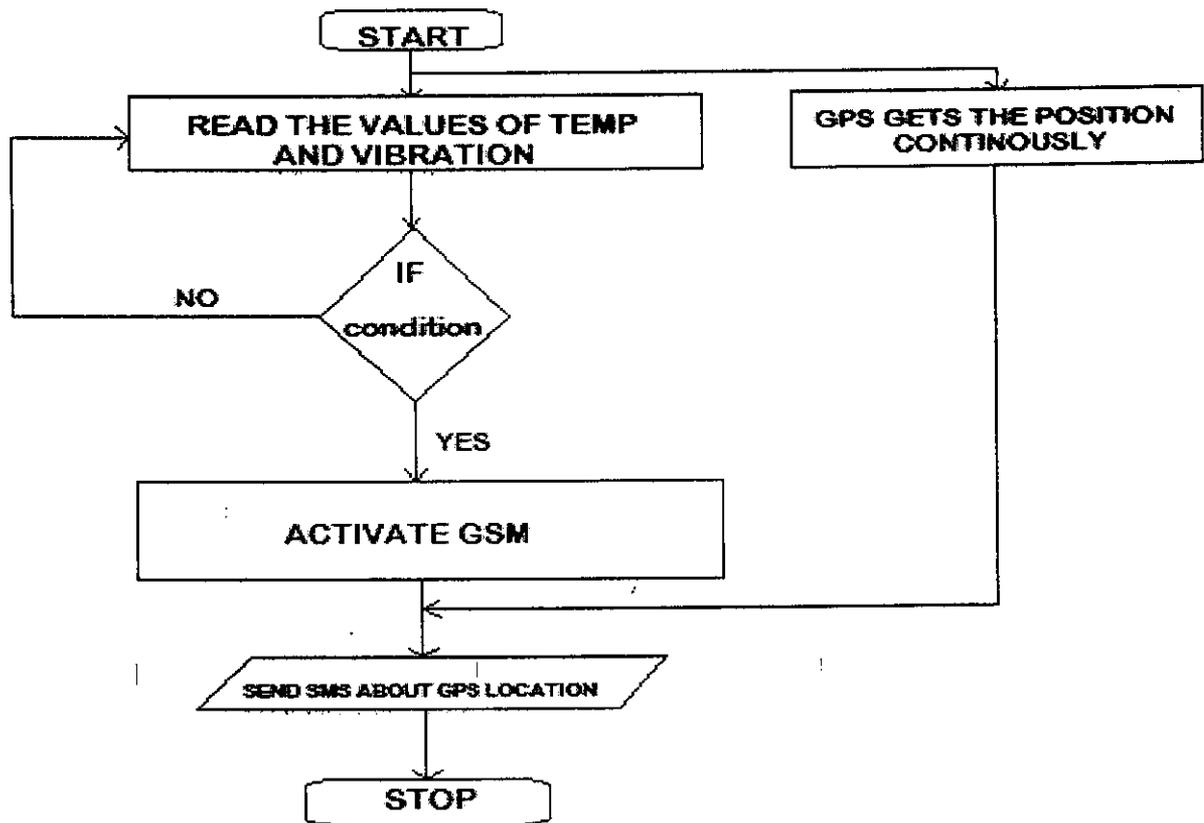


Fig 3.2 Flow Chart

CHAPTER 4

HARDWARE REQUIREMENTS

1. Microcontroller PIC16F877A
2. GSM and GPS module
3. Power Supply
4. Sensors
5. LCD

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 μ A typical @ 3V, 32 kHz

4.1.2. PIN DIAGRAM OF PIC 16F874A/877A

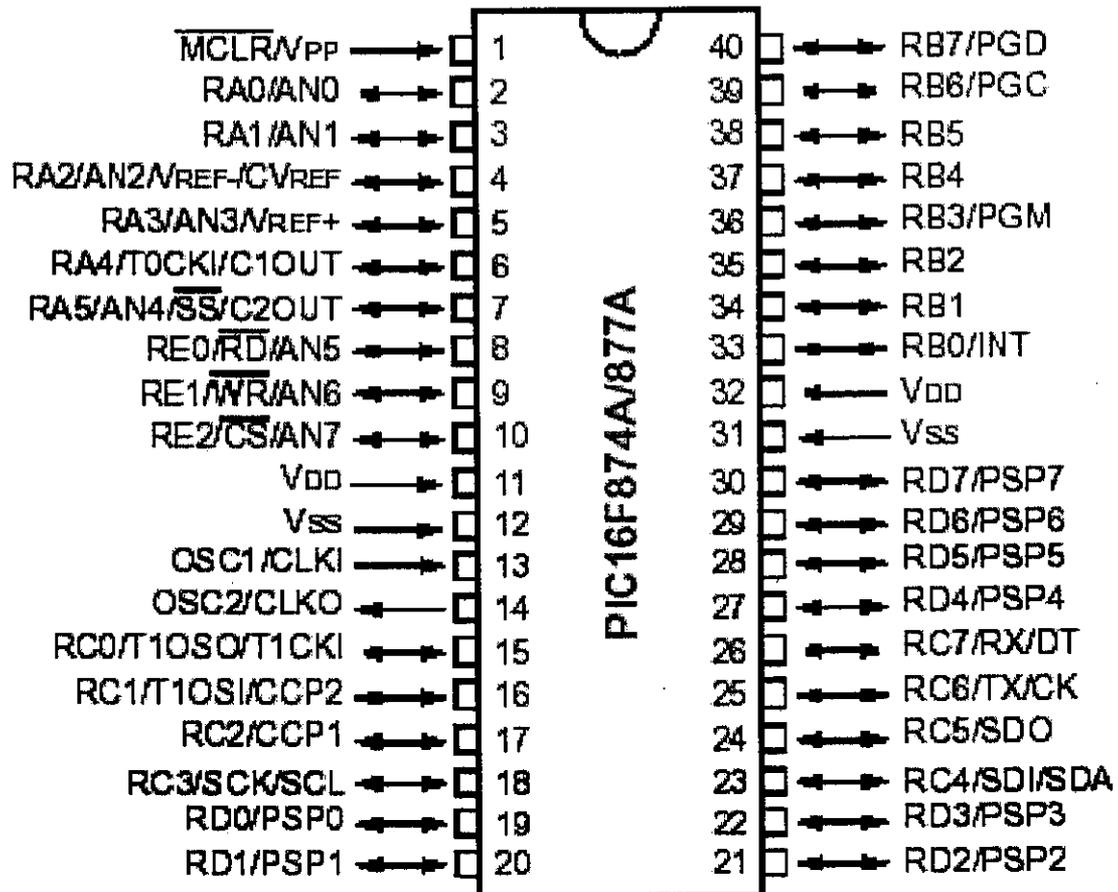


Fig 4.1 Pin diagram of PIC 16F877A

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

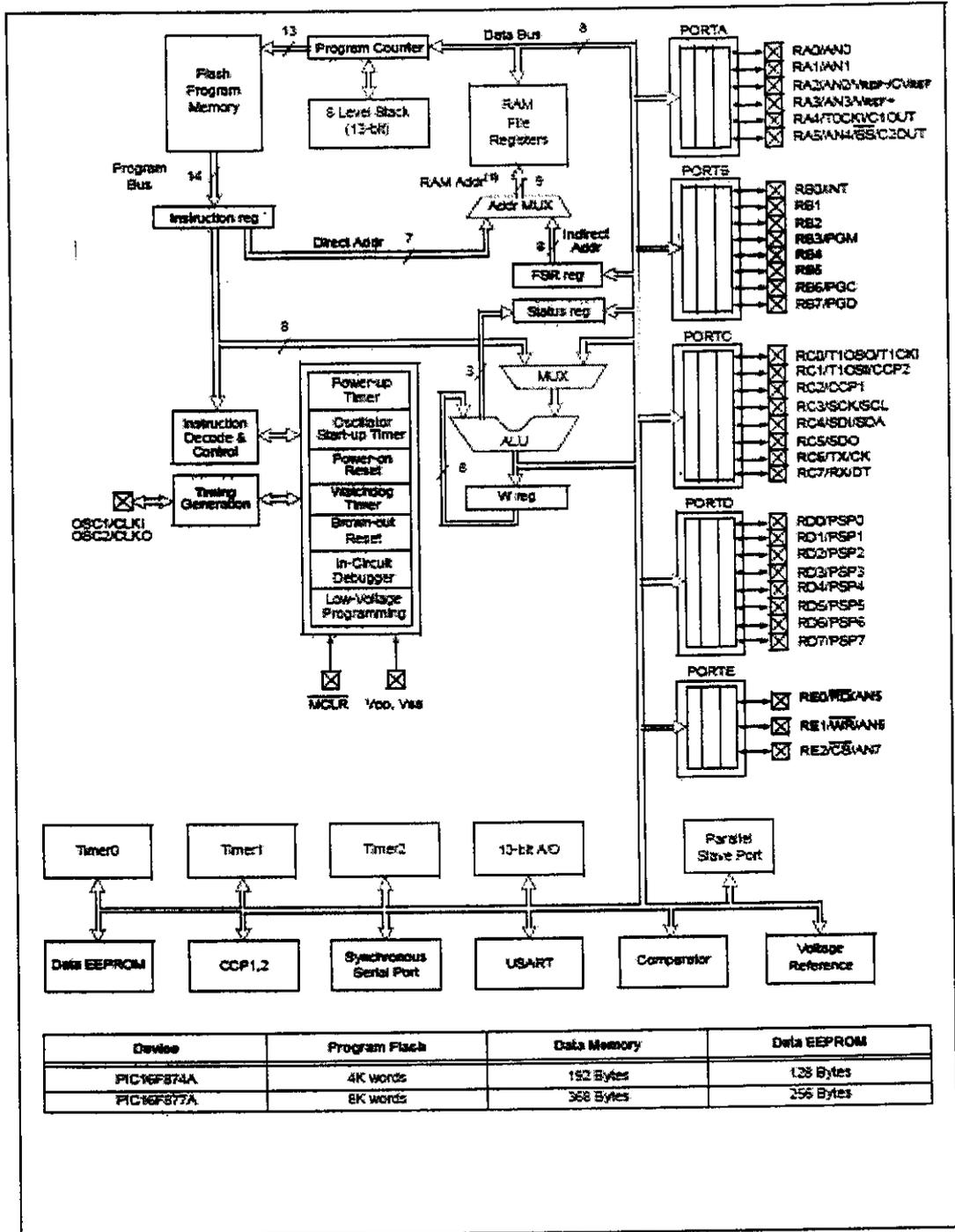


Fig 4.2 Architecture of PIC

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

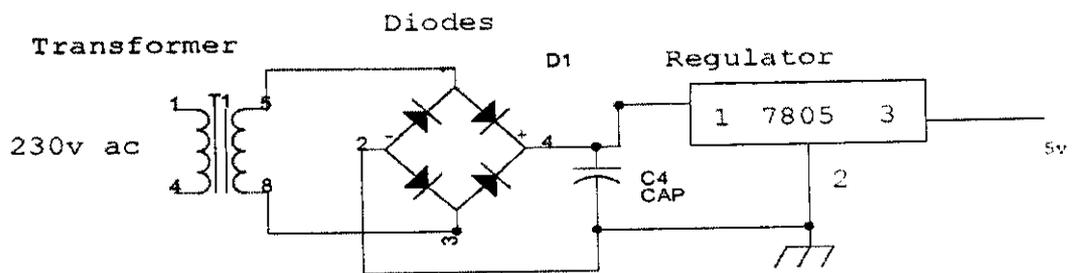


Fig 4.3 Power supply unit

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.

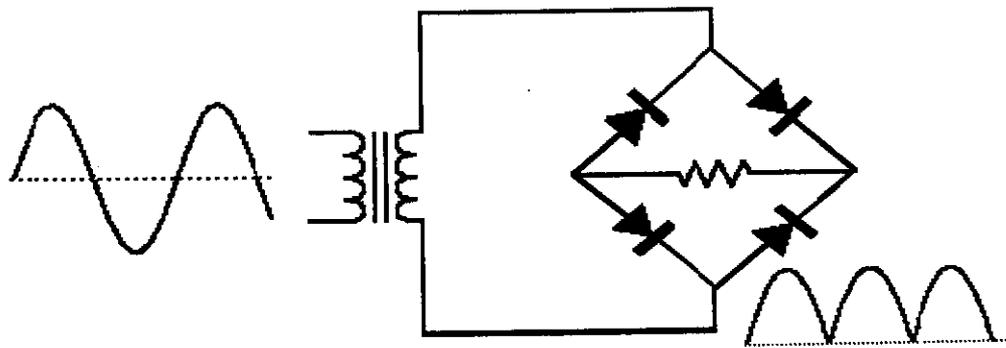


Fig 4.4 Bridge rectifier

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

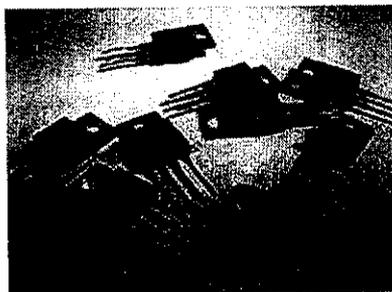


Fig 4.6 An assortment of 78xx series ICs

"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

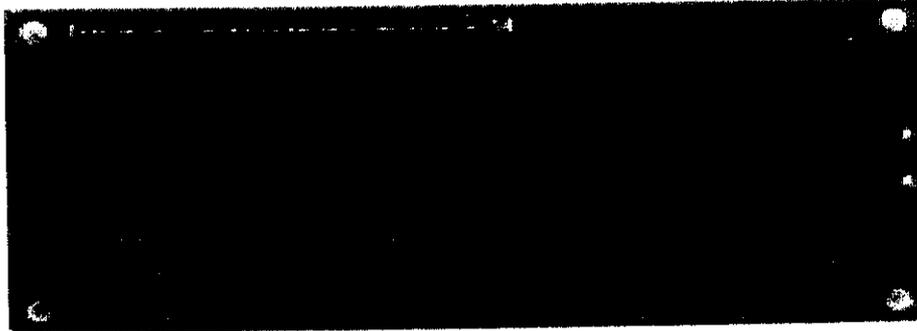


Fig 4.7 LCD display

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 USART

4.4.1 Serial communication

A serial port sends and receives data one bit at a time over one wire. While it takes eight times as long as to transfer each byte of data this way, only a few wires are required. In fact, two-way (full duplex) communications is possible with only

three separate wires- one to send, one to receive, and a common signal ground wire.

- Bi-directional communication
- Communicating by wires
- The Parity Bit
- Cable lengths
- MAX-232C
- DCE And DTE devices
- Synchronous and Asynchronous Communications

Bi-directional Communications

The serial port on your PC is a full-duplex device meaning that it can send and receive data at the same time. In order to be able to do this, it uses separate lines for transmitting and receiving data. Some types of serial devices support only one-way communications and therefore use only two-wires in the cable – the transmit line and the signal ground.

Communicating by bits

Once the start bit has been sent, the transmitter sends the actual data bits. There may either be 5,6,7, or 8 data bits, depending on the number you have selected. Both receiver and the transmitter must agree on the number of data bits, as well as the baud rate. Almost all devices transmit data using either 7 or 8 data bits. Notice that when only 7 data bits are employed, you cannot send ASCII values greater than 127. Likewise, using 5 bits limits the highest possible value to 31. After the data has been transmitted, a stop bit is sent. A stop bit has a value of

1- or a mark state- and it can be detected correctly even if the previous data bit also had a value of 1. This is accomplished by the stop bit's duration.

The Parity Bit

Besides the synchronization provided by the use of start and stop bits, an additional bit called a parity bit may optionally be transmitted along with the data. A parity bit affords a small amount of error checking, to help detect data corruption that might occur during transmission.

Cable Lengths

The MAX-232 standard imposes a cable length limit of 50 feet. You can usually ignore this "standard", since a cable can be as long as 10000 feet at baud rates up to 19200 if you use a high quality, well shielded cable. The external environment has a large effect on lengths for unshielded cables.

4.4.2 MAX232 (Voltage Converter)

Since the RS232 is not compatible with today's microprocessors and micro controller, we need line driver to convert the RS232 signals to TTL voltage levels that will be acceptable to the 8051's TXD and RXD pins. One example of such a converter is MAX 232 from maxim corp. The MAX 232 converts from RS232 voltage levels to TTL voltage levels, and vice versa. One advantage of MAX232 chip is that it uses a +5V power source, which is the same as the source voltage for the PIC 16f877A micro controller. In other words, with a single +5v power supply we can power both the PIC and MAX 232, with no need of for the dual power supplies that are common in many older systems. The MAX 232 requires four

capacitors ranging from 1 to 22 microfarad. The most widely used value for this capacitor is 22microfarad.

PIN DIAGRAM OF MAX232

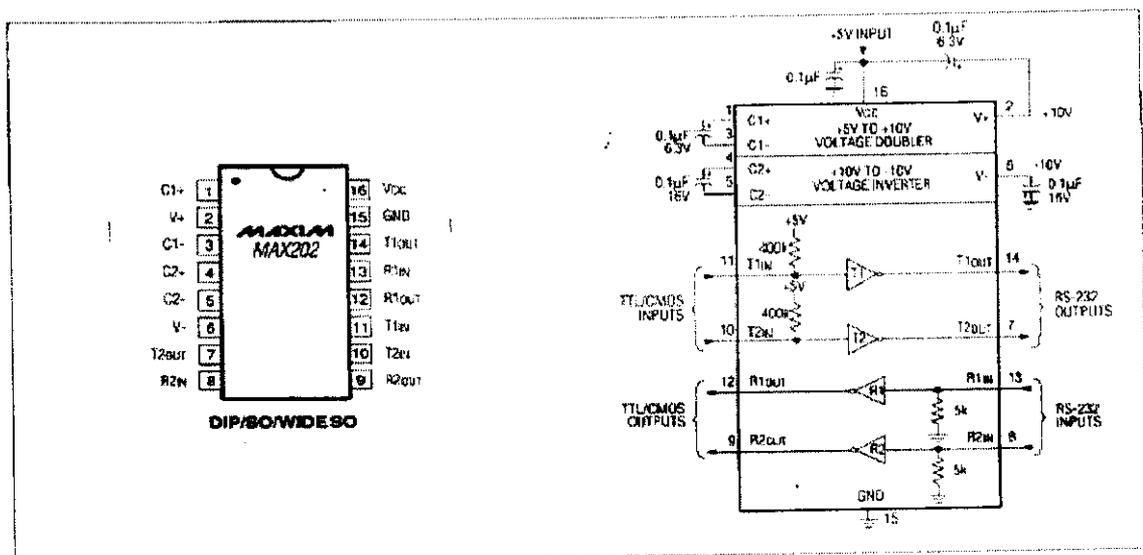


Fig 4.8 MAX232 pin diagram

DCE and DTE devices

Two terms you should be familiar with are DTE and DCE. DTE stands for Data Terminal Equipment, and DCE stands for Data Communication Equipment. These terms are used to indicate the pin-out for the connectors on a device and the direction of the signals on the pins. Your computer is a DTE device, while most other devices are usually DCE devices. If you have trouble keeping the two straight then replace the term "DTE device" with your PC and the term DCE device with "remote Device" in the following discussion. The RS-232 standard

states that DTE devices use a 25-pin male connector, and DCE devices use a 25-pin female connector. You can therefore connect a DTE device to a DCE using a straight pin-for-pin connection. However, to connect two like devices, you must instead use a null modem cable. Null modem cables cross the transmit and receive lines in the cable.

The DTE device puts this line in a mark condition to tell the remote device that it is ready and able to receive data. If the DTE device is not able to receive data (typically because its receive buffer is almost full), it will put this line in the space condition as a signal to the DCE to stop sending data. When the DTE device is ready to receive more data it will place this line back in the mark condition. The complement of the RTS wire is CTS, which stands for Clear to Send. The DCE device puts this line in a mark condition to tell the DTE device that it is ready to receive the data. Likewise, if the DCE device is unable to receive data, it will place this line in the space condition. Together, these two lines make up what is called RTS/CTS or "hardware" flow control. The software wedge supports this type of flow control as well as Xon/Xoff or "software" flow control. Software flow control uses special control characters transmitted from one device to another to tell the other device to stop or start sending data. With software flow control the RTS and CTS lines are not used.

DTR stands for Data Terminal Ready. Its intended function is very similar to the RTS line. **DSR** (Data Set Ready) is the companion to DTR in the same way that CTS is to RTS. Some serial devices use DTR and DSR as signals to simplify confirm that a device is connected and turned on. The software wedge sets DTR to the mark state when the serial port is opened and leaves it in that state until the port is closed. The DTR and DSR lines were originally designed to provide an alternate method of hardware handshaking. It would be pointless to use both RTS/CTS and

DTR/DSR for flow control signals at the same time. Because of this DTR and DSR are rarely used for flow control.

Synchronous and Asynchronous Communications

There are two basic types of serial communications, synchronous and asynchronous. With synchronous communications, the two devices initially synchronize themselves to each other, and then continually send characters to stay in sync. Even when the data is not really being sent, a constant flow of bits allows each device to know where the other is at any given time. That is, each character that is sent is either actual data or an idle character. Synchronous communications allows faster data transfer rates than asynchronous methods, because additional bits to mark the beginning and end of each data byte are not required. The serial ports on IBM style PCs are asynchronous devices and therefore only support asynchronous serial communications. Asynchronous means no “synchronization”, and thus does not require sending and receiving idle characters. However, the beginning and end of each byte of data must be identified by start and stop bits. The start bit indicates when the data byte is about to begin and the stop bit signals when it ends. The requirement to send these additional two bits causes asynchronous communication to be slightly slower than synchronous however it has the advantage that the processor does not have to deal with the additional idle characters.

4.5 GSM COMMUNICATION

4.5.1 Introduction

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz, It is estimated that many countries outside of Europe will join the GSM partnership.

Cellular is one of the fastest growing and most demanding telecommunications applications. Throughout the evolution of cellular telecommunications, various systems have been developed without the benefit of standardized specifications. This presented many problems directly related to compatibility, especially with the development of digital radio technology. The GSM standard is intended to address these problems.

From 1982 to 1985 discussions were held to decide between building an analog or digital system. After multiple field tests, a digital system was adopted for GSM. The next task was to decide between a narrow or broadband solution. In May 1987, the narrowband time division multiple access (TDMA) solution was chosen.

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems: the switching system (SS), the base station system (BSS), and the operation and support system (OSS).

4.5.2 GSM Architecture

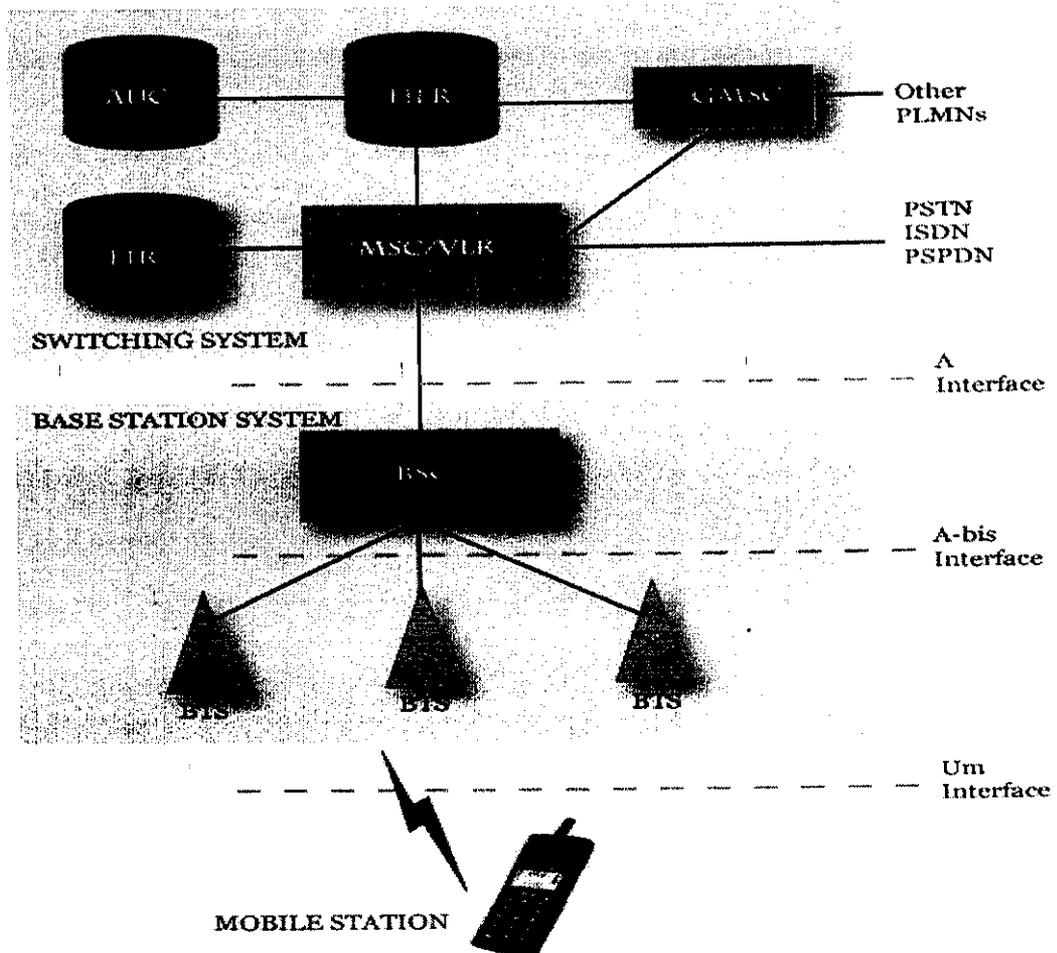


Fig 4.9 GSM architecture

The Switching System:

The switching system (SS) is responsible for performing call processing and subscriber-related functions. The switching system includes the following functional units.

Home Location Register (HLR) —The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription from one of the PCS operators, he or she is registered in the HLR of that operator.

Mobile Services Switching Center (MSC) —The MSC performs the telephony switching functions of the system. It controls calls to and from other telephone and data systems. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others.

Visitor Location Register (VLR) —The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.

Authentication Center (AUC) —A unit called the AUC provides authentication and encryption parameters that verify the user's identity and ensure the confidentiality of each call. The AUC protects network operators from different types of fraud found in today's cellular world.

Equipment Identity Register (EIR) —The EIR is a database that contains information about the identity of mobile equipment that prevents calls from stolen, unauthorized, or defective mobile stations. The AUC and EIR are implemented as stand-alone nodes or as a combined AUC/EIR node.

The Base Station System (BSS):

All radio-related functions are performed in the BSS, which consists of base station controllers (BSCs) and the base transceiver stations (BTSs).

BSC —The BSC provides all the control functions and physical links between the MSC and BTS. It is a high-capacity switch that provides functions such as handover, cell configuration data, and control of radio frequency (RF) power levels in base transceiver stations. A number of BSCs are served by an MSC.

BTS —The BTS handles the radio interface to the mobile station. The BTS is the radio equipment (transceivers and antennas) needed to service each cell in the network. A group of BTSs are controlled by a BSC.

The Operation and Support System:

The operations and maintenance center (OMC) is connected to all equipment in the switching system and to the BSC. The implementation of OMC is called the operation and support system (OSS). The OSS is the functional entity from which the network operator monitors and controls the system. The purpose of OSS is to offer the customer cost-effective support for centralized, regional, and local operational and maintenance activities that are required for a GSM network. An important function of OSS is to provide a network overview and support the maintenance activities of different operation and maintenance organizations.

4.5.3 Additional Functional Elements

Message Center (MXE) —The MXE is a node that provides integrated voice, fax, and data messaging. Specifically, the MXE handles short message service, cell broadcast, voice mail, fax mail, e-mail, and notification.

Mobile Service Node (MSN) —The MSN is the node that handles the mobile intelligent network (IN) services.

Gateway Mobile Services Switching Center (GMSC) —A gateway is a node used to interconnect two networks. The gateway is often implemented in an MSC. The MSC is then referred to as the GMSC.

Gsm Interworking Unit (GIWU) —The GIWU consists of both hardware and software that provides an interface to various networks for data communications. Through the GIWU, users can alternate between speech and data during the same call. The GIWU hardware equipment is physically located at the MSC/VLR

4.5.4 GSM Cellular Network

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. GSM networks operate in four different frequency ranges. Most GSM networks operate in the 900 MHz or 1800 MHz bands. Some countries in the Americas (including Canada and the United States) use the 850 MHz and 1900 MHz bands because the 900 and 1800 MHz frequency bands were already allocated. The rarer 400 and 450 MHz frequency bands are assigned in some countries where these frequencies were previously used for first-generation systems.

GSM-900 uses 890–915 MHz to send information from the mobile station to the base station (uplink) and 935–960 MHz for the other direction (downlink), providing 124 RF channels (channel numbers 1 to 124) spaced at 200 kHz. Duplex spacing of 45 MHz is used. In some countries the GSM-900 band has been extended to cover a larger frequency range. This 'extended GSM', E-GSM, uses 880–915 MHz (uplink) and 925–960 MHz (downlink), adding 50 channels (channel numbers 975 to 1023 and 0) to the original GSM-900 band. Time division

multiplexing is used to allow eight full-rate or sixteen half-rate speech channels per radio frequency channel. There are eight radio timeslots (giving eight burst periods) grouped into what is called a TDMA frame. Half rate channels use alternate frames in the same timeslot. The channel data rate for all 8 channels is 270.833 kbit/s, and the frame duration is 4.615 ms.

GSM has used a variety of voice codec's to squeeze 3.1 kHz audio into between 5.6 and 13 kbit/s. Originally, two codecs, named after the types of data channel they were allocated, were used, called Half Rate (5.6 kbit/s) and Full Rate (13 kbit/s). These used a system based upon linear predictive coding (LPC). In addition to being efficient with bitrates, these codecs also made it easier to identify more important parts of the audio, allowing the air interface layer to prioritize and better protect these parts of the signal

GSM transmitter

One of the key features of GSM is the Subscriber Identity Module (SIM), commonly known as a **SIM card**. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets. Alternatively, the user can also change operators while retaining the handset simply by changing the SIM. Some operators will block this by allowing the phone to use only a single SIM, or only a SIM issued by them; this practice is known as SIM locking, and is illegal in some countries.

GSM Modems and Modules

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed

telephone line while a wireless modem sends and receives data through radio waves. A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier.

4.5.5 Sim300 GSM Module (GSM / GPRS: SIM300)

Detailed Modem Description:

The Sim300 is a Tri-Brand GSM GPRS solution in a compact plug-in module.

Featuring an industry-standard interface, the sim300 delivers GSM GPRS 900 1800 1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. The leading features of Sim300 make it ideal for virtually unlimited application, such as WLL applications (Fixed Cellular Terminal), M2M application, handheld devices and much more.

- 1) Sim300 is a Tri-band GSM GPRS module with a size of 40x33x2. 85mm
- 2) Customized MMI and keypad LCD support
- 3) An embedded Powerful TCP IP protocol stack
- 4) Based upon mature and field-proven platform, backed up by our support service, from definition to design and production.

4.6 GPS Receiver

The GPS Smart Receiver is an ultra low power GPS receiver based on the proven technology found in this 16 channel GPS receivers and NEMERIX chipset solution. The positioning application meets strict needs such as car navigation, mapping, surveying, security, agriculture and so on. Only clear view of sky and certain power supply are necessary to the device. With its ultra low power consumption, the smart receiver tracks up to 16 satellites at a time, re-acquires satellite signals in 1 second (average) and updates position data every second.

The GPS smart receiver features the 16 channels .Ultra low power GPS architecture. This complete enabled GPS receiver provides high position, velocity and time accuracy performances as well as high sensitivity and tracking capabilities. The ultra low power CMOS technology, the GPS receiver is ideal for many portable applications such as PDA, Tablet PC, smart phone etc. s49 processor is used.



Fig 4.10 GPS receiver

Features

- 16-channels GPS search engine
- Ultra low power design (38mA, typical)
- Compact size

- Built-in low noise, high gain active antenna
- High sensitivity
- Apply to host devices with USB or RS232

Applications

- Personal/Portable Navigation (PDA)
- Geographic Surveying

Benefits

- Ultra low power consumption
- Easy and fast to install
- Low cost with high performance

4.7. Precision Centigrade Temperature Sensors

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4^{\circ}\text{C}$ at room temperature and $\pm 3/4^{\circ}\text{C}$ over a full -55 to $+150^{\circ}\text{C}$ temperature range.

4.8. Vibration Sensor

A **piezoelectric sensor** is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal. A piezoelectric transducer has very high DC output impedance and can be modeled as a proportional voltage source . The voltage at the source is directly proportional to the applied vibration, force, pressure, or strain.

CHAPTER 5

SOFTWARE REQUIREMENT

5.1 Software tools

- MPLAB
- Protel
- Propic
- HI-Tech PIC C Compiler

5.2 MPLAB INTEGRATION

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PIC micro 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 simulator to MPLAB ICD 2 or the MPLAB ICE emulator is done in a flash because MPLAB IDE has the same user interface for all tools.

Choose MPLAB C18, the highly optimized compiler for the PIC18 series microcontrollers, or try the newest Microchip's language tools compiler, MPLAB C30, targeted at the high performance PIC24 and dsPIC digital signal controllers. Or, use one of the many products from third party language tools vendors. They integrate into MPLAB IDE to function transparently from the MPLAB project manager, editor and compiler.

5.3 INTRODUCTION TO EMBEDDED 'C'

Ex: Hitec – c, Keil – c

HI-TECH Software makes industrial-strength software development tools and C compilers that help software developers write compact, efficient embedded processor code.

For over two decades HI-TECH Software has delivered the industry's most reliable embedded software development tools and compilers for writing efficient and compact code to run on the most popular embedded processors. Used by tens of thousands of customers including General Motors, Whirlpool, Qualcomm, John Deere and many others, HI-TECH's reliable development tools and C compilers, combined with world-class support have helped serious embedded software programmers to create hundreds of breakthrough new solutions.

Whichever embedded processor family you are targeting with your software, whether it is the ARM, PICC or 8051 series, HI-TECH tools and C compilers can help you write better code and bring it to market faster.

HI-TECH PICC is a high-performance C compiler for the Microchip PIC micro 10/12/14/16/17 series of microcontrollers. HI-TECH PICC is an industrial-strength ANSI C compiler - not a subset implementation like some other PIC compilers. The PICC compiler implements full ISO/ANSI C, with the exception of recursion. All data types are supported including 24 and 32 bit IEEE standard floating point. HI-TECH PICC makes full use of specific PIC features and using an intelligent optimizer, can generate high-quality code easily rivaling hand-written assembler. Automatic handling of page and bank selection frees the programmer from the trivial details of assembler code.

5.4 EMBEDDED “C” COMPILER

- ANSI C - full featured and portable
- Reliable - mature, field-proven technology
- Multiple C optimization levels
- An optimizing assembler
- Full linker, with overlaying of local variables to minimize RAM usage
- Comprehensive C library with all source code provided
- Includes support for 24-bit and 32-bit IEEE floating point and 32-bit long data types
- Mixed C and assembler programming
- Unlimited number of source files
- Listings showing generated assembler
- Compatible - integrates into the MPLAB IDE, MPLAB ICD and most 3rd-party development tools
- Runs on multiple platforms: Windows, Linux, UNIX, Mac OS X, Solaris

P-3541

5.5 EMBEDDED C TOOLS

5.5.1 Assembler

An assembler is a computer program for translating assembly language — essentially, a mnemonic representation of machine language — into object code. A cross assembler (see cross compiler) produces code for one type of processor, but runs on another. The computational step where an assembler is run is known as assembly time. Translating assembly instruction mnemonics into opcodes, assemblers provide the ability to use symbolic names for memory locations (saving

tedious calculations and manually updating addresses when a program is slightly modified), and macro facilities for performing textual substitution — typically used to encode common short sequences of instructions to run inline instead of in a subroutine. Assemblers are far simpler to write than compilers for high-level languages.

Benefits of assembly language

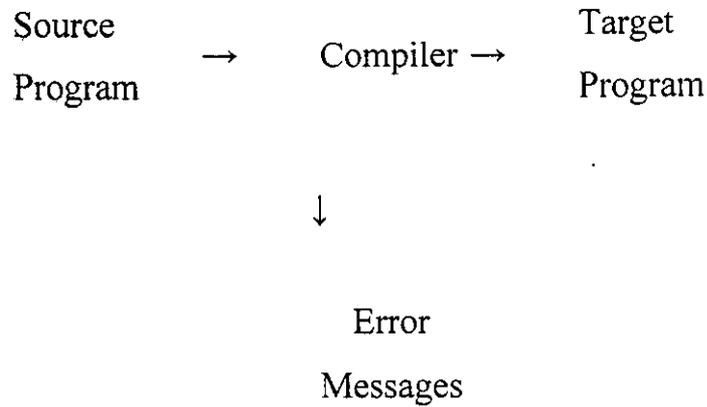
Speed: Assembly language programs are generally the fastest programs around.

Space: Assembly language programs are often the smallest.

Capability: They can do things in assembly which are difficult or impossible in High level languages.

5.5.2 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.



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.

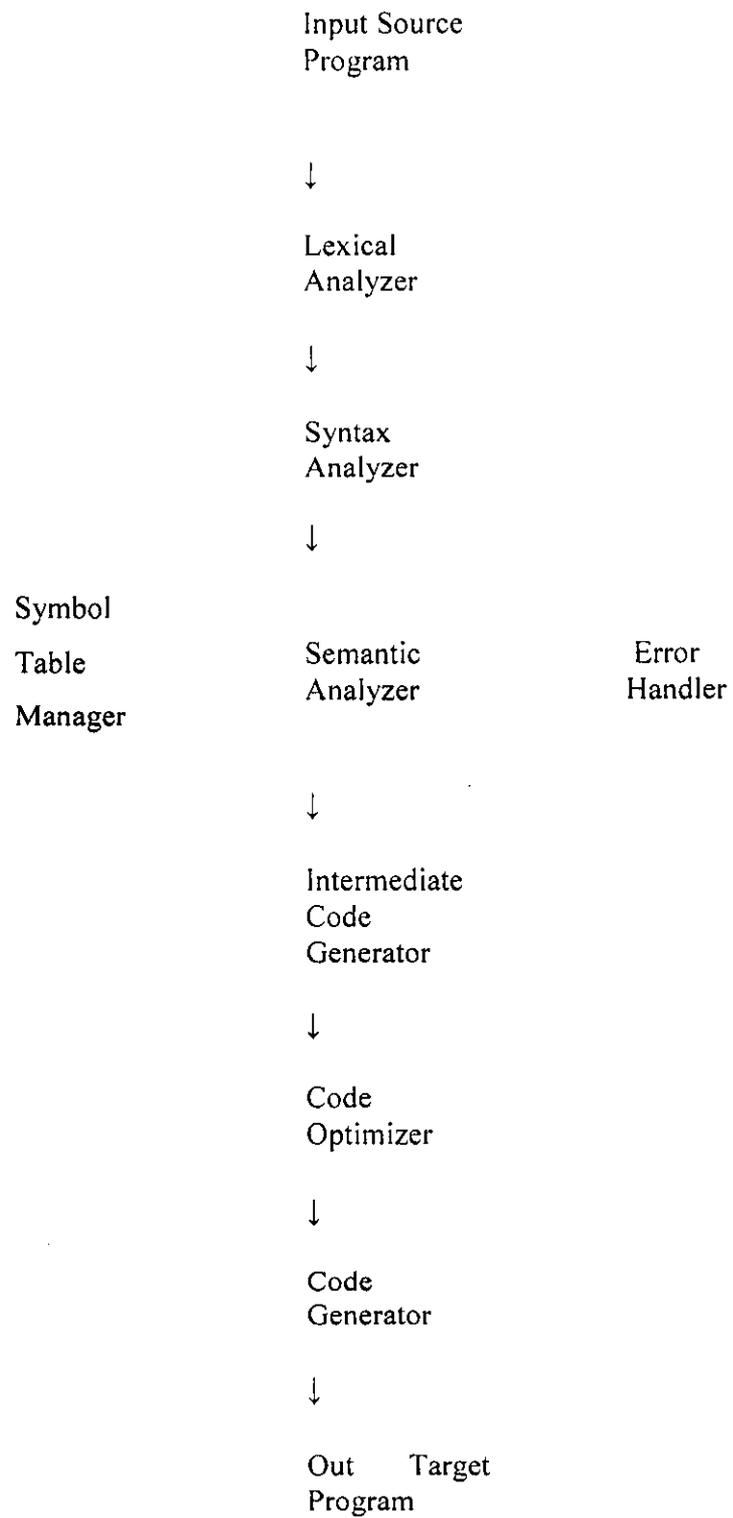


Fig 5.1 Phases of compiler

5.6 Tools

Like typical computer programmers, embedded system designers use compilers, assemblers, and debuggers to develop embedded system software. However, they also use a few tools that are unfamiliar to most programmers.

Software tools can come from several sources:

- Software companies that specialize in the embedded market.
- Ported from the GNU software development tools.

Sometimes, development tools for a personal computer can be used if the embedded processor is a close relative to a common PC processor. Embedded system designers also use a few software tools rarely used by typical computer programmers. One common tool is an "in-circuit emulator" (ICE) or, in more modern designs, an embedded debugger. This debugging tool is the fundamental trick used to develop embedded code. It replaces or plugs into the microprocessor, and provides facilities to quickly load and debug experimental code in the system. A small pod usually provides the special electronics to plug into the system. Often a personal computer with special software attaches to the pod to provide the debugging interface. Another common tool is a utility program (often home-grown) to add a checksum or CRC to a program, so it can check its program data before executing it.

An embedded programmer that develops software for digital signal processing often has a math workbench such as MathCad or Mathematical to simulate the mathematics. Less common are utility programs to turn data files into code, so one can include any kind of data in a program. A few projects use Synchronous programming languages for extra reliability or digital signal processing.

CHAPTER 6

APPLICATIONS AND ADVANTAGES

APPLICATIONS:

The entire project idea is to develop an automatic accident alert system used

- to inform the emergency services at times of danger automatically.
- as automatic accident detector.
- in mines and other hazardous areas.

ADVANTAGES:

- Low cost and low power consumption by the equipment.
- Fast response from sensors.
- It will reduce the number of deaths in case of accidents.
- Less weight and it is easily portable.

CHAPTER 7

CONCLUSION

This project provides solution to implement a low cost automatic emergency indicator in case of accidents, it helps in effective rescue operations. It finds its application in many hazardous working environments.

In this project, we have used sensors which detect the body parameters and in case of an emergency, the GSM module is activated which gets the location from GPS receiver and sends message to the pre stored number which may be the emergency service.

Thus implementation of this project helps in effective rescue of victims and save a number lives at the time of accident.

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