COMA MONITORING SYSTEM

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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ABSTRACT

The coma patient monitoring system provides high quality health care services. Nowadays it is difficult for continuous monitoring of coma patients in the hospitals due to lack of man power. Hence a necessity of automatic monitoring of coma patients was created. Such necessity would be fulfilled with the application of electronics and embedded systems in realtime so that the patients were taken care. This system provides convenient and comprehensive medical monitoring in understaffed hospitals. It provides continuous monitoring of coma patients and patients with neurodegenerative problems as well as senior citizens. The system measures physical changes in body movement and the biological signals of the patient and gives warning in the form of an alarm and display along with an SMS to the doctor using a GSM module.

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LIST OF ABBREVATIONS

PIC   Peripheral Interface controller

EEPROM   Electrically Erasable Programmable Read Only Memory

SRAM   Static Random Access Memory

LCD   Liquid crystal display

UART   Universal Asynchronous Receiver Transmitter

USB   Universal Serial Bus

ADC   Analog to Digital Converter

Txr PIN   Transmitter PIN

Rxr PIN   Reciever PIN

MIC   Microphone

BPF   Band Pass filter

BORN   Brown out reset enable

WDTDIS   Watchdog timer disable

CHAPTER 1

INTRODUCTION

Our project, the coma patient monitoring system provides high quality health care services. It provides convenient and comprehensive medical monitoring in understaffed hospitals. It provides continuous monitoring of coma patients and patients with neurodegenerative problems as well as senior citizens. The system measures physical changes in body movement and the biological signals of the patient and gives warning in the form of an alarm and display along with an SMS to the doctor using a GSM module. To develop a smart health monitoring system to measure the biological signals of patients. All round autonomous monitoring system without any human intervention. It is useful for ICU and coma afflicted patients in hospitals with insufficient personnel.

CHAPTER 2

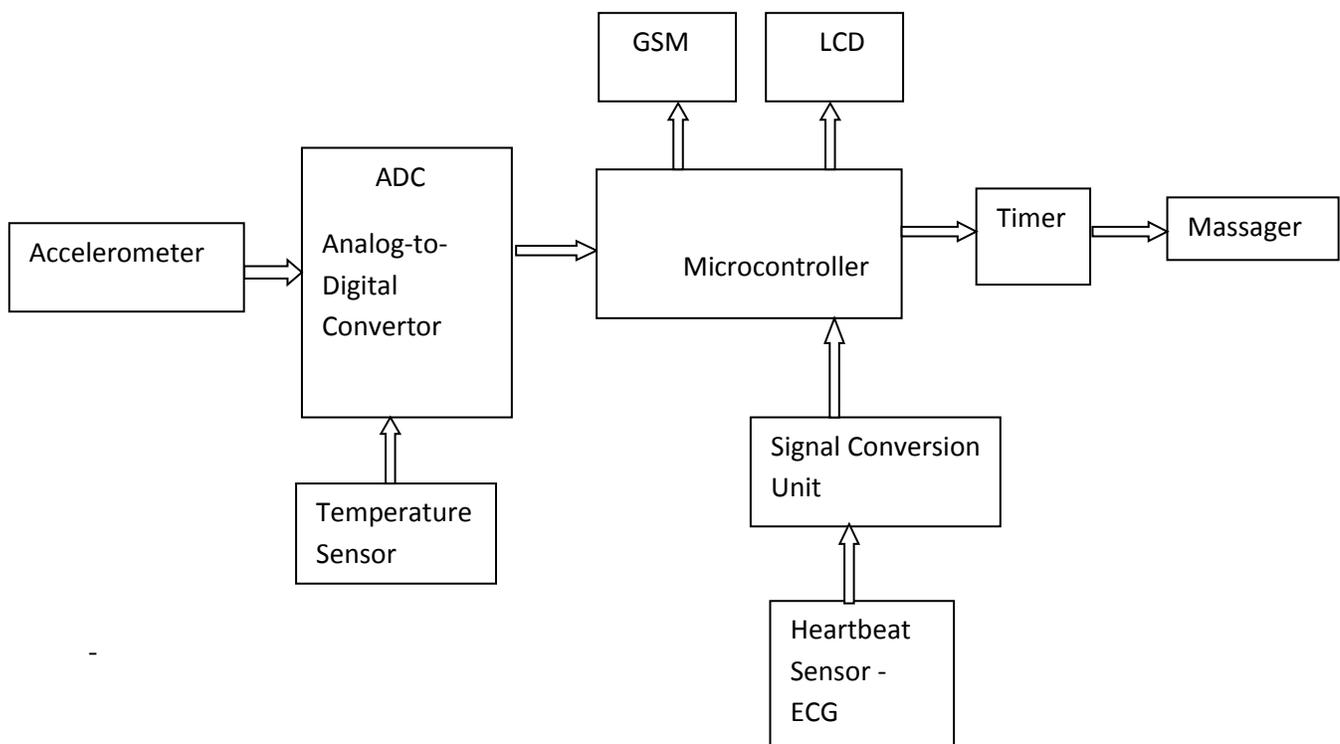# HARDWARE DESCRIPTION

2.1 BLOCK DIAGRAM

Figure 1:Block Diagram

2.2 POWER SUPPLY

POWER SUPPLY

Figure 2:Circuit Diagram of Power Supply

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.

2.2.1. LINEAR POWER SUPPLY:

An AC powered linear power supply usually uses a transformer to convert the voltage from the wall outlet to a lower voltage. If it is used to produce DC, a rectifier is used. A capacitor is used to smooth the pulsating current from the rectifier. Some small periodic deviations from smooth direct current will remain, which is known as ripple. These pulsations occur at a frequency related to the AC power frequency.

The voltage produced by an unregulated power supply will vary depending on the load and on variations in the AC supply voltage. For critical electronics applications a linear regulator will be used to stabilize and adjust the voltage. This regulator will also greatly reduce the ripple and noise in the output direct current. Linear regulators often provide current limiting, protecting the power supply and attached circuit from over current.

Adjustable linear power supplies are common laboratory and service shop test equipment, allowing the output voltage to be set over a wide range.
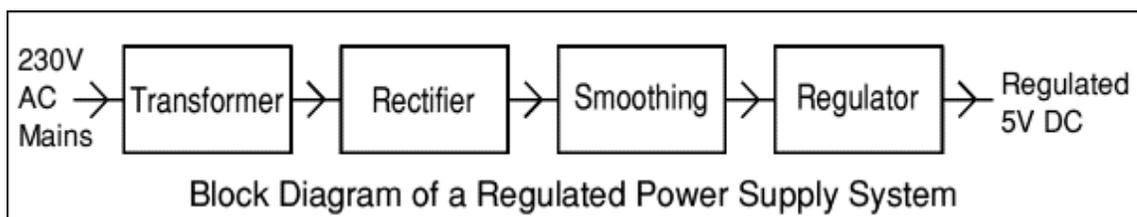

230V AC Mains → Transformer → Rectifier → Smoothing → Regulator → Regulated 5V DC

Block Diagram of a Regulated Power Supply System

Figure 3: Block Diagram of Regulated Power Supply
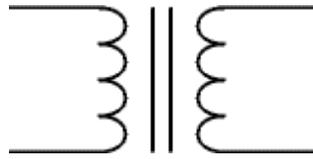
2.2.2.TRANSFORMER:

Figure 4: Transformer

Transformers convert AC from one voltage to another with little loss of power. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage to a safer low voltage.

The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core.

The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage. Turns ratio=Vp/Vs=Nn/Ns and Power out=Power in

$Vs*Is=Vp * Ip$

Vp   =primary   (input)   voltage   Vs = secondary (output) voltage
Np = number of turns on primary coil   Ns = number of turns on secondary coil
Ip   = primary (input) current   Is = secondary (output) current

2.2.3.RECTIFIER:

There are several ways of connecting diodes to make a rectifier to convert AC to DC. The bridge rectifier is the most important and it produces full-wave varying DC. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A single diode can be used as a rectifier but it only uses the positive (+) parts of the AC wave to produce half-wave varying DC.
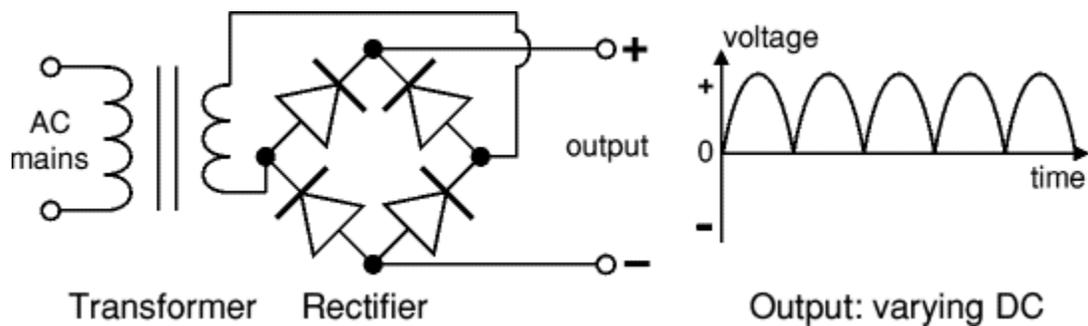

Figure 5: Block Diagram of Rectifier

The varying DC output is suitable for lamps, heaters and standard motors. It is not suitable for electronic circuits unless they include a smoothing capacitor.

2.2.4.REGULATOR:

Voltage regulator ICs are available with fixed (typically 5, 12 and 15V) or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection').

The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. Many of the fixed voltage regulator ICs has 3 leads and look like power transistors, such as the 7805 +5V 1A regulator shown on the right. They include a hole for attaching a heat sink.

1. Positive regulator

    1. Input pin
    2. Ground pin
    3. Output pin

It regulates the positive voltage

2. Negative regulator

    1. Ground pin
    2. Input pin
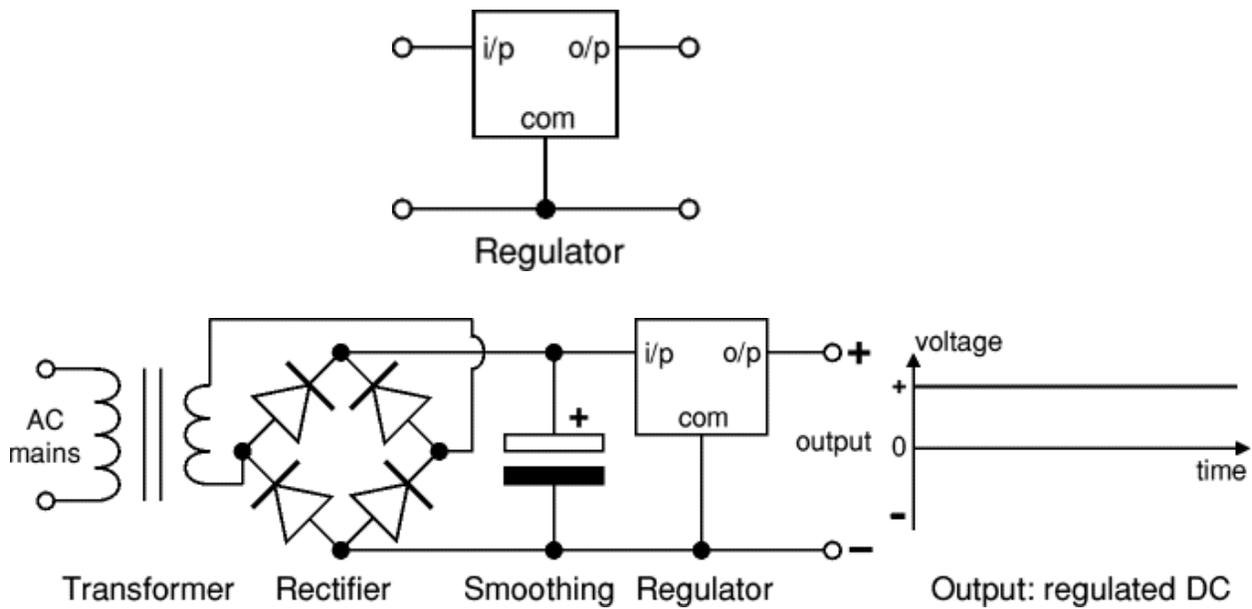   3. Output pin

It regulate the negative voltage

Figure 6: Block Diagram of Regulator

The regulated DC output is very smooth with no ripple. It is suitable for all electronic circuits.

2.3 PIC MICROCONTROLLER

2.3.1. PIC 16F877 Architecture

PIC 16F877 is a 40-pin 8-Bit CMOS FLASH Microcontroller from Microchip. The core architecture is high-performance RISC CPU with only 35 single word instructions. Since it follows the RISC architecture, all single cycle instructions take only one instruction cycle except for program branches which take two cycles. 16F877 comes with 3 operating speeds with 4, 8, or 20 MHz clock input. Since each instruction cycle takes four operating clock cycles, each instruction takes 0.2 ms when 20MHz oscillator is used.

It has two types of internal memories: program memory and data memory. Program memory is provided by 8K words (or 8K*14 bits) of FLASH Memory, and data memory has two sources. One type of data memory is a 368-byte RAM (random access memory) and the other is 256-byte EEPROM (Electrically erasable programmable ROM).

The core feature includes interrupt capability up to 14 sources, power saving SLEEP mode, and single 5V In-Circuit Serial Programming (ICSP) capability. The sink/source current, which indicates a driving power from I/O port, is high with 25mA. Power consumption is less than 2 mA in 5V operating condition.

The peripheral features include:

3 Time Blocks:

Timer0: For 8-bit timer/counter

Timer1: For 16-bit timer/counter and

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

Two Capture, Compare, PWM modules for capturing, comparing 16-bit, and PWM generation with 10-bit resolution.

10-bit multi-channel (max 8)Analog-to-Digital converter module.

Synchronous Serial Port (SSP) with SPI (Master Mode) and I^2C^2 (Master/Slave)

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

TABLE 1.KEY FEATURES OF 16F877A

FLASH Program Memory (14-bit word)	8K Words
Data Memory (RAM)	368 Bytes
Data Memory (EEPROM)	256 Bytes
Interrupts	14
I/O Ports	Ports A, B, C, D, E
Timers	3
Capture/Compare/PWM Modules	2
Serial Communications	MSSP, USART

Parallel Communications	PSP
10-bit Analog-to-Digital Module	8 channels
Instruction Set	35 Instructions

2.3.2. Pin and Package:

There are three package types are available: DIP, PLCC, and QFP. This book assumes that we all use the DIP because of its best fit to breadboard or proto-board.
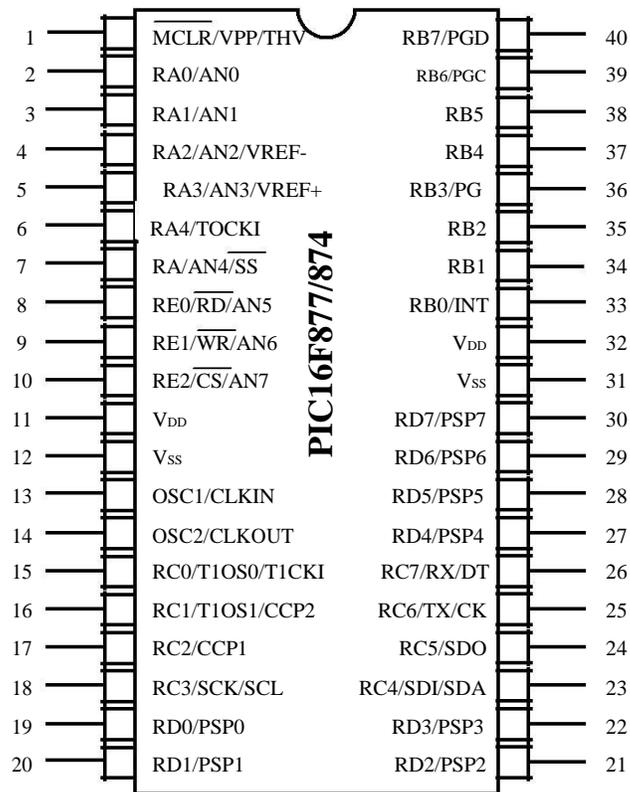
Pin	Left	Right	Pin
1	$\overline{MCLR}$/VPP/THV	RB7/PGD	40
2	RA0/AN0	RB6/PGC	39
3	RA1/AN1	RB5	38
4	RA2/AN2/VREF-	RB4	37
5	RA3/AN3/VREF+	RB3/PG	36
6	RA4/TOCKI	RB2	35
7	RA/AN4/$\overline{SS}$	RB1	34
8	RE0/$\overline{RD}$/AN5	RB0/INT	33
9	RE1/$\overline{WR}$/AN6	V_{DD}	32
10	RE2/$\overline{CS}$/AN7	V_{SS}	31
11	V_{DD}	RD7/PSP7	30
12	V_{SS}	RD6/PSP6	29
13	OSC1/CLKIN	RD5/PSP5	28
14	OSC2/CLKOUT	RD4/PSP4	27
15	RC0/T1OS0/T1CKI	RC7/RX/DT	26
16	RC1/T1OS1/CCP2	RC6/TX/CK	25
17	RC2/CCP1	RC5/SDO	24
18	RC3/SCK/SCL	RC4/SDI/SDA	23
19	RD0/PSP0	RD3/PSP3	22
20	RD1/PSP1	RD2/PSP2	21

PIC16F877/874

Figure 7: Pin Diagram of 16f877a

2.3.3.PIC microcontroller:

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1640. Originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "**Programmable Interface Controller**".

PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

- Microchip announced on February 2008 the shipment of its six billionth PIC processor.

2.3.4.Core architecture:

The PIC architecture is characterized by the following features:

- Separate code and data spaces (Harvard architecture) for devices other than PIC32, which has a Von Neumann architecture.
- A small number of fixed length instructions
- Most instructions are single cycle execution (2 clock cycles), with one delay cycle on branches and skips
- One accumulator (W0), the use of which (as source operand) is implied (i.e. is not encoded in the opcode)

- All RAM locations function as registers as both source and/or destination of math and other functions.

- A hardware stack for storing return addresses

- A fairly small amount of addressable data space (typically 256 bytes), extended through banking

- Data space mapped CPU, port, and peripheral registers

- The program counter is also mapped into the data space and writable (this is used to implement indirect jumps).

There is no distinction between memory space and register space because the RAM serves the job of both memory and registers, and the RAM is usually just referred to as the register file or simply as the registers.

2.3.5. Data space (RAM):

PICs have a set of registers that function as general purpose RAM. Special purpose control registers for on-chip hardware resources are also mapped into the data space. The addressability of memory varies depending on device series, and all PIC devices have some banking mechanism to extend addressing to additional memory. Later series of devices feature move instructions which can cover the whole addressable space, independent of the selected bank. In earlier devices, any register move had to be achieved via the accumulator.

To implement indirect addressing, a "file select register" (FSR) and "indirect register" (INDF) are used. A register number is written to the FSR, after which reads from or writes to INDF will actually be to or from the register pointed to by FSR. Later devices extended this concept with post- and pre- increment/decrement for

greater efficiency in accessing sequentially stored data. This also allows FSR to be treated almost like a stack pointer (SP).

2.3.6.Code space:

The code space is generally implemented as ROM, EPROM or flash ROM. In general, external code memory is not directly addressable due to the lack of an external memory interface. The exceptions are PIC17 and select high pin count PIC18 devices.

2.3.7.Word size:

The word size of PICs can be a source of confusion. All PICs handle (and address) data in 8-bit chunks, so they should be called 8-bit microcontrollers. However, the unit of addressability of the code space is not generally the same as the data space. For example, PICs in the baseline and mid-range families have program memory addressable in the same wordsize as the instruction width, i.e. 12 or 14 bits respectively. In contrast, in the PIC18 series, the program memory is addressed in 8-bit increments (bytes), which differs from the instruction width of 16 bits.

2.3.8.Stacks:

PICs have a hardware call stack, which is used to save return addresses. The hardware stack is not software accessible on earlier devices, but this changed with the 18 series devices.

Hardware support for a general purpose parameter stack was lacking in early series, but this greatly improved in the 18 series, making the 18 series architecture more friendly to high level language compilers.

2.3.9.Limits:

The PIC architectures have several limits:

- Only one accumulator
- A small instruction set
- Operations and registers are not orthogonal; some instructions can address RAM and/or immediate constants, while others can only use the accumulator
- Memory must be directly referenced in arithmetic and logic operations, although indirect addressing is available via 2 additional registers
- Register-bank switching is required to access the entire RAM of many devices

The following limitations have been addressed in the PIC18, but still apply to earlier cores:

- Conditional skip instructions are used instead of conditional jump instructions used by most other architectures
- Indexed addressing mode is very rudimentary
- Stack:
  - The hardware call stack is so small that program structure must often be flattened
  - The hardware call stack is not addressable, so pre-emptive task switching cannot be implemented
  - Software-implemented stacks are not efficient, so it is difficult to generate reentrant code and support local variables
- Program memory is not directly addressable, and thus space-inefficient and/or time-consuming to access. With paged program memory, there are two page sizes to worry about: one for CALL and GOTO and another for computed

GOTO . For computed GOTOs, where you add to PCL, the page size is 256 instruction words. In both cases, the upper address bits are provided by the PCLATH register. This register must be changed every time control transfers between pages. PCLATH must also be preserved by any interrupt handler.

2.3.10.PIC24 and dsPIC 16-bit microcontrollers:

In 2001, Microchip introduced the dsPIC series of chips, which entered mass production in late 2004. They are Microchip's first inherently 16-bit microcontrollers. PIC24 devices are designed as general purpose microcontrollers. dsPIC devices include digital signal processing capabilities in addition.

Architecturally, although they share the PIC moniker, they are very different from the 8-bit PICs. The most notable differences are:

- They feature a set of 16 working registers (W0-W15)
- They fully support a stack in RAM, and do not have a hardware stack
- Bank switching is not required to access RAM or special function registers
- Data stored in program memory can be accessed directly using a feature called Program Space Visibility
- Interrupt sources may be assigned to distinct handlers using an interrupt vector table

Some features are:

- Hardware MAC (multiply-accumulate)
- Barrel shifting
- Bit reversal

- (16×16)-bit single-cycle multiplication and other DSP operations

- Hardware divide assist (19 cycles for 16/32-bit divide)

- Hardware support for loop indexing

- Direct memory access

2.3.11. Variants:

Within a series, there are still many device variants depending on what hardware resources the chip features.

- General purpose I/O pins.

- Internal clock oscillators.

- 8/16/32 Bit Timers.

- Internal EEPROM Memory.

- Synchronous/Asynchronous Serial Interface USART.

- MSSP Peripheral for I²C and SPI Communications.

- Capture/Compare and PWM modules.

- Analog-to-digital converters (up to ~1.0 MHz).

- USB, Ethernet, CAN interfacing support.

- External memory interface.

- Integrated analog RF front ends (PIC16F639, and rfPIC).

- KEELOQ Rolling code encryption peripheral (encode/decode)

- And many more.

2.3.12. Trends:

The first generation of PICs with EPROM storage are almost completely replaced by chips with Flash memory. Likewise, the original 12-bit instruction set of the PIC1650 and its direct descendants has been superseded by 14-bit and 16-bit instruction sets. Microchip still sells OTP (one-time-programmable) and windowed (UV-erasable) versions of some of its EPROM based PICs for legacy support or volume orders. The Microchip website lists PICs that are not electrically erasable as OTP despite the fact that UV erasable windowed versions of these chips can be ordered.

2.3.13. Development tools:

Commercially supported:

Microchip provides a freeware IDE package called MPLAB, which includes an assembler, linker, software simulator, and debugger. They also sell C compilers for the PIC18 and dsPIC which integrate cleanly with MPLAB. Free student versions of the C compilers are also available with all features. But for the free versions, optimizations will be disabled after 60 days.[10]

Several third parties make C, BASIC and Pascal language compilers for PICs, many of which integrate to MPLAB and/or feature their own IDE. A fully featured compiler for the PICBASIC language to program PIC microcontrollers is available from meLabs, Inc.

A blockset for Matlab/Simulink allows one to generate C and binary files from a Simulink model. Most common peripherals have a blockset and you do not need to write the configuration code.

2.3.14. 8/16/32-bit PIC microcontroller product families:

8-bit microcontrollers

- PIC10
- PIC12
- PIC14
- PIC16
- PIC17
- PIC18

16-bit microcontrollers

- PIC24F
- PIC24H

32-bit microcontrollers

- PIC32

16-bit digital signal controllers

- dsPIC30
- dsPIC33F

The F in a name generally indicates the PICmicro uses flash memory and can be erased electronically. A C generally means it can only be erased by exposing the die to ultraviolet light (which is only possible if a windowed package style is used). An exception to this rule is the PIC16C84 which uses EEPROM and is therefore electrically erasable.

2.4 RELAY CIRCUIT

2.4.1. Relays:

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

Circuit symbol for a relay

two switch positions and most have double throw (changeover) switch contacts as shown in the diagram.

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits, the link is magnetic and mechanical. The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays

Figure 8:Relay

designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are usuallly 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.

The coil will be obvious and it may be connected either way round. Relay coils produce brief high voltage 'spikes' when they are switched off and this can destroy transistors and ICs in the circuit. To prevent damage you must connect a protection diode across the relay coil.

The relay's switch connections are usually labeled COM, NC and NO:

- **COM** = Common, always connect to this, it is the moving part of the switch.
- **NC** = Normally Closed, COM is connected to this when the relay coil is **off**.
- **NO** = Normally Open, COM is connected to this when the relay coil is **on**.
- Connect to COM and NO if you want the switched circuit to be **on when the relay coil is on**.
- Connect to COM and NC if you want the switched circuit to be **on when the relay coil is off**.

2.4.2.Choosing a relay:

Consider several features when choosing a relay:
1. Physical size and pin arrangement:

If you are choosing a relay for an existing PCB you will need to ensure that its dimensions and pin arrangement are suitable. You should find this information in the supplier's catalogue.

2. Coil voltage:

The relay's coil voltage rating and resistance must suit the circuit powering the relay coil. Many relays have a coil rated for a 12V supply but 5V and 24V relays are also readily available. Some relays operate perfectly well with a supply voltage which is a little lower than their rated value.

3. Coil resistance:

The circuit must be able to supply the current required by the relay coil. You can use Ohm's law to calculate the current:

$$\text{Relay coil current } = \frac{\text{supply voltage}}{\text{coil resistance}}$$

4. Switch ratings(voltage and current)

The relay's switch contacts must be suitable for the circuit they are to control. You will need to check the voltage and current ratings. Note that the voltage rating is usually higher for AC, for example: "5A at 24V DC or 125V AC".

5. Switch contact arrangement(SPDT,DPDT etc)

Most relays are SPDT or DPDT which are often described as "single pole changeover" (SPCO) or "double pole changeover" (DPCO).

2.4.3. Protection diodes for relays

Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. Current flowing through a relay coil creates a magnetic field which collapses suddenly when the current is switched off. The sudden collapse of the magnetic field induces a brief high voltage across the relay coil which is very likely to damage transistors and ICs. The protection diode allows the induced voltage to drive a brief current through the coil so the magnetic field dies away quickly rather than instantly. This prevents the induced voltage becoming high enough to cause damage to transistors and ICs.

2.4.4. Advantages of relays:

- Relays can switch AC and DC, transistors can only switch DC.
- Relays can switch higher voltages than standard transistors.
- Relays are often a better choice for switching large currents (> 5A).
- Relays can switch many contacts at once.

2.4.5.Disadvantages of relays:

- Relays are bulkier than transistors for switching small currents.
- Relays cannot switch rapidly (except reed relays), transistors can switch many times per second.
- Relays use more power due to the current flowing through their coil.

2.5 DC MOTOR:

2.5.1.DESCRIPTION:

DC motors are part of the electric motors using DC power as energy source. These devices transform electrical energy into mechanical energy. The basic principle of DC motors is same as electric motors in general, the magnetic interaction between the rotor and the stator that will generate spin.

Simple motor has six parts:

1. Armature or rotor
2. Commutator
3. Brushes
4. Axle
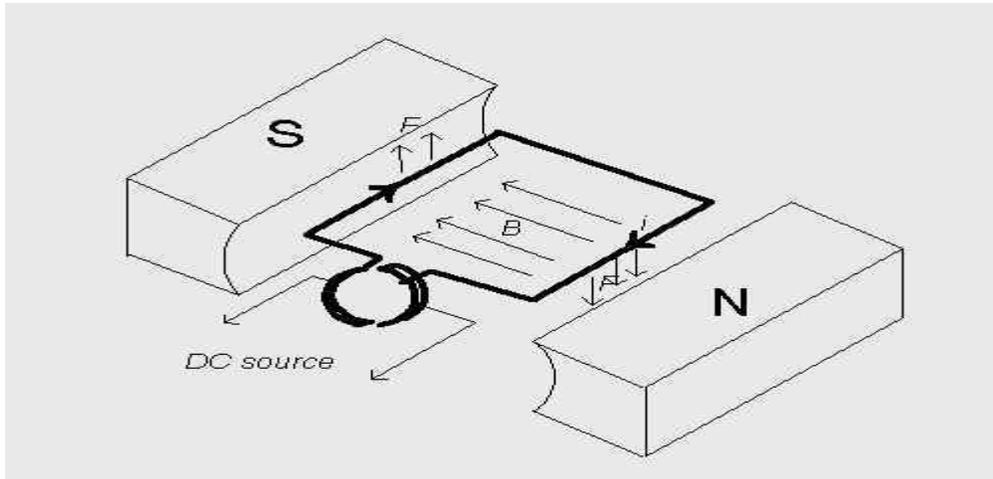5. Field magnet
6. DC power supply of some sort

2.5.2. Working Principle of DC Motor

Figure 9: DC MOTOR

When DC electric current flowing in the coil in accordance with the direction of the arrow, while the direction of the magnetic field B is from north to south pole, the coil will be driven by the force F in the direction as shown in Figure 1. This condition occurs continuously so will result in rotation on the axis of the coil. The direction of the electric current in the coil is fixed, because of the split ring on the end of the coil.

The major classes of DC motors are

- Shunt wound.
- Series wound.
- Compound wound.
- Separately excited.

These types of motors differ only in the connection of the field circuits The armatures, commutators, and so forth are nearly identical with each other and with those of the generators. All four major classes of motors are widely used. This is in

contrast to the generators, in which the compound wound type is used for nearly all general power applications.

2.5.3.Brushless motor:

A DC Brushless Motor uses a permanent magnet **external** rotor, three phases of driving coils, one or more Hall effect devices to sense the position of the rotor, and the associated drive electronics. The coils are activated, one phase after the other, by the drive electronics as cued by the signals from the Hall effect sensors, they act as three-phase synchronous motors containing their own variable frequency drive electronics.

2.6 LCD DISPLAY

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

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

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.
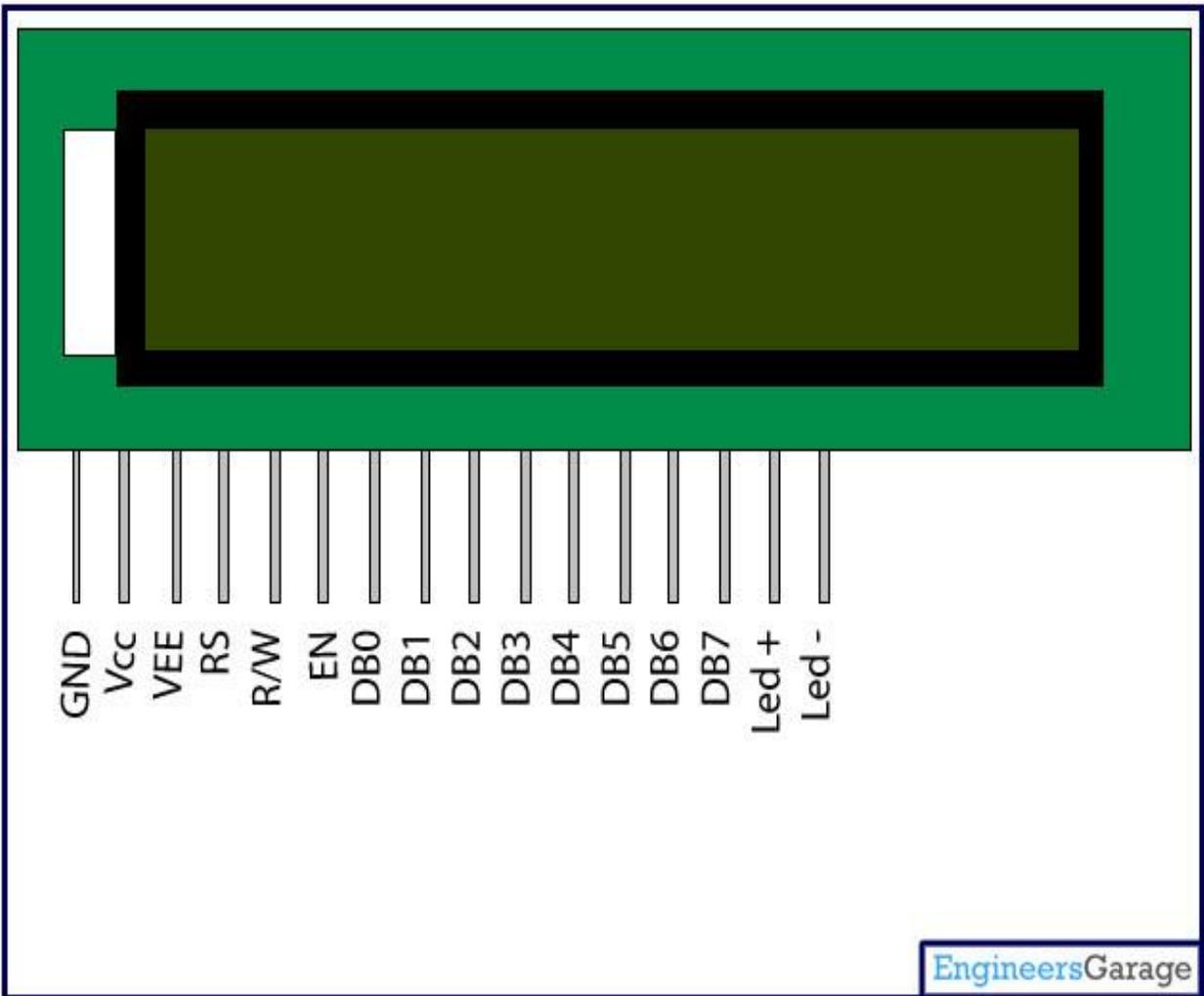
Figure 10: Pin Diagram of LCD Display

TABLE 2. SUMMARY OF LCD

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

2.6.1 LCD INTERFACING WITH PIC 16F877

Programming PIC for Interfacing 16X2 LCD:

Only the pins, registers and architecture using for interfacing will be different. When we look at the program, functions like initialization, sending data to the LCD will be almost same. In the pic programming also for initializing the LCD the R/W pin should be low for writing the data, Enable pins should be high and register select pin (RS) should be high for writing the data. For sending a command the RS should be low, R/W pin should be low and enable pin should be high.

Initializing the LCD function:

lcdcmd(0x38);//Configure the LCD in 8-bit mode,2 line and 5×7 font
lcdcmd(0x0C);// Display On and Cursor Off
lcdcmd(0x01);// Clear display screen
lcdcmd(0x06);// Increment cursor
lcdcmd(0x80);// Set cursor position to 1st line,1st column

Sending command to the LC:

- rs=0;   Register select pin is low.
- rw=0; Read/write Pin is also for writing the command to the LCD.
- en=1;enable pin is high.

Sending data to the LCD:

- rs=1; Register select pin is high.
- rw=0; Read/write Pin is also for writing the command to the LCD.
- en=1; enable pin is high.

STEPS FOR PROGRAMMING:

- Install MPLAB in your system and create a new project, in selecting device and family select PIC16F family and add PIC16F877 controller to your project.

- Select the compiler which you have installed and add the file to your project. After adding the file paste the code which is given below and run it. As it is a precompiled and tested program you will not find any errors.

- After compiling the program with no errors dump the program into your development board using PICKIT2 or PICKIT3 programmer/ debugger.

- If you are not using PICKIT then just compile the code and make the HEX file use this HEX file for programming the PIC microcontroller.

2.7 TEMPERATURE SENSOR (LM35):

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ^{o}C). The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified.
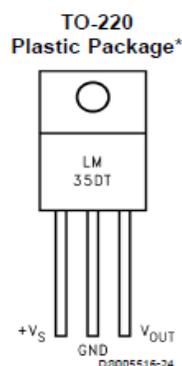

TO-220
Plastic Package*

LM
35DT

+V$_S$ GND   V$_{OUT}$
DS005516-24

Figure 11: Pin Diagram of LM35

2.7.1.DESCRIPTION:

- ➤ It has an output voltage that is proportional to the Celsius temperature.
- ➤ The scale factor is .01V/^{o}C
- ➤ The LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4 ^{o}C at room temperature and +/- 0.8 ^{o}C over a range of 0 ^{o}C to +100 ^{o}C.
- ➤ Another important characteristic of the LM35DZ is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The sensor self-heating causes less than 0.1 ^{o}C temperature rise in still air.

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 ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies.

As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air.

The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C is rated for a -40° to +110°C range (-10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package

2.7.2. Features:

- ➢ Calibrated directly in ° Celsius (Centigrade)
- ➢ Linear + 10.0 mV/°C scale factor
- ➢ 0.5°C accuracy guarantee able (at +25°C)
- ➢ Rated for full −55° to +150°C range
- ➢ Suitable for remote applications
- ➢ Low cost due to wafer-level trimming
- ➢ Operates from 4 to 30 volts
- ➢ Less than 60 µA current drain
- ➢ Low self-heating, 0.08°C in still air
- ➢ Nonlinearity only ±1⁄4°C typical
- ➢ Low impedance output, 0.1 W for 1 mA load

2.8 SERIAL RS232:

The RS-232 standard defines voltages and general baud rate ranges for serial communications between devices using it. We won't be getting the voltages exactly right, but for most applications, we'll be close enough. Until recently, most desktop computers had an RS-232 or similar serial port. Now, many desktop computers are shifting to other forms of serial communication such as USB, or Universal Serial Bus, and Firewire, which allow for more flexible configurations and faster data rates. the RS-232 standard is still very common in other devices, though, as it is cheaper to use than USB, simpler to implement, consumes less power, and provides more than adequate speeds for exchanging control data (i.e. data that allows one device to control another).

UART (Universal Asynchronous Receiver Transmitter) or USART (Universal Synchronous Asynchronous Receiver Transmitter) are one of the basic interfaces which you will find in almost all the controllers available in the market till date. This interface provides a cost effective simple and reliable communication between one controller to another controller or between a controller and PC.

In telecommunications, RS-232 (Recommended Standard 232) is a standard for serial binary data signals connecting between a DTE (Data Terminal Equipment) and a DCE (Data Circuit-terminating Equipment). It is commonly used in computer serial ports. A similar ITU-T standard is V.24.
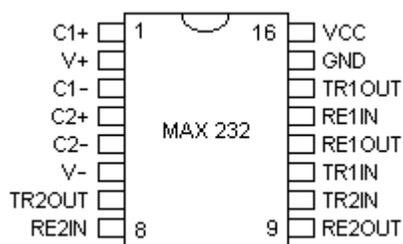
2.8.1.MAX232:

Figure 12: Pin Diagram of MAX232

Description:

The **MAX232** is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case.
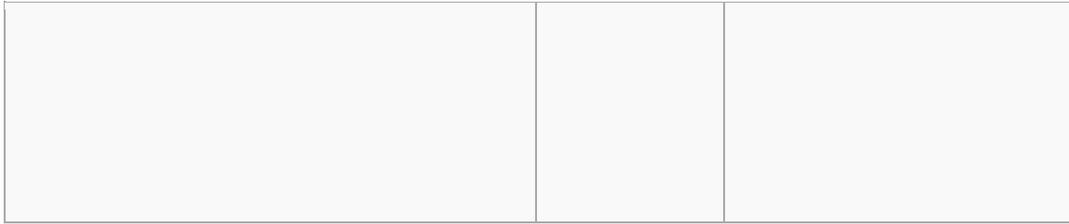
The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.

The later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors – 0.1 µF in place of the 1.0 µF capacitors used with the original device.

When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15V, and changes TTL Logic 1 to between -3 to -15V, and vice versa for converting from RS232 to TTL. The RS232 Data Transmission voltages at a certain logic state are opposite from the RS232 Control Line voltages at the same logic state.

TABLE 3. RS232 VOLTAGE LEVEL

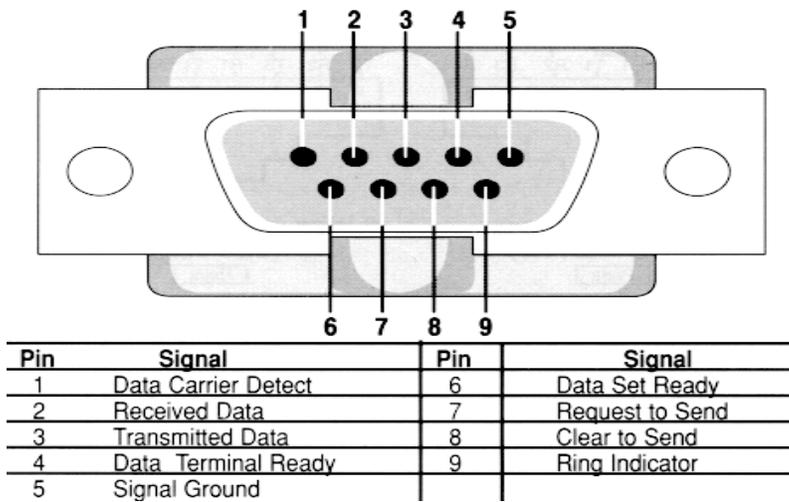| RS232 Line Type & Logic Level	RS232 Voltage	TTL Voltage to/from MAX232
Data Transmission (Rx/Tx) Logic 0	+3V to +15V	0V
Data Transmission (Rx/Tx) Logic 1	-3V to -15V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 0	-3V to -15V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 1	+3V to +15V	0V

2.8.2.RS232 PIN DETAILS:

Pin	Signal	Pin	Signal
1	Data Carrier Detect	6	Data Set Ready
2	Received Data	7	Request to Send
3	Transmitted Data	8	Clear to Send
4	Data Terminal Ready	9	Ring Indicator
5	Signal Ground		

Figure 13: RS232 Pin Details

TABLE 4: SUMMARY OF RS232

Abbreviation	Full Name	Function

1	TD	Transmit Data	Serial Data Output (TXD)
2	RD	Receive Data	Serial Data Input (RXD)
3	CTS	Clear to Send	This line indicates that the Modem is ready to exchange data.
4	DCD	Data Carrier Detect	When the modem detects a "Carrier" from the modem at the other end of the phone line, this Line becomes active.
5	DSR	Data Set Ready	This tells the UART that the modem is ready to establish a link.
6	DTR	Data Terminal Ready	This is the opposite to DSR. This tells the Modem that the UART is ready to link.
7	RTS	Request To Send	This line informs the Modem that the UART is ready to exchange data.
8	RI	Ring Indicator	Goes active when modem detects a ringing signal from the PSTN.

2.8.3.Advantages:

✓ Serial Cables can be longer than Parallel cables. The serial port transmits a '1' as -3 to -25 volts and a '0' as +3 to +25 volts where as a parallel port transmits a '0' as 0v and a '1' as 5v. Therefore the serial port can have a maximum swing of 50V compared to the parallel port which has a maximum swing of 5 Volts. Therefore cable loss is not going to be as much of a problem for serial cables as they are for parallel.

✓ Wires are less than parallel transmission.

✓ Serial transmission is used where one bit is sent at a time.

Microcontrollers have also proven to be quite popular recently. Many of these have in built SCI (Serial Communications Interfaces) which can be used to talk to the outside world. Serial Communication reduces the pin count of these MPU's.

2.9 ACCELEROMETER:

The ADXL335 is a small, thin, low power, complete 3-axis accel-erometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 *g*. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.
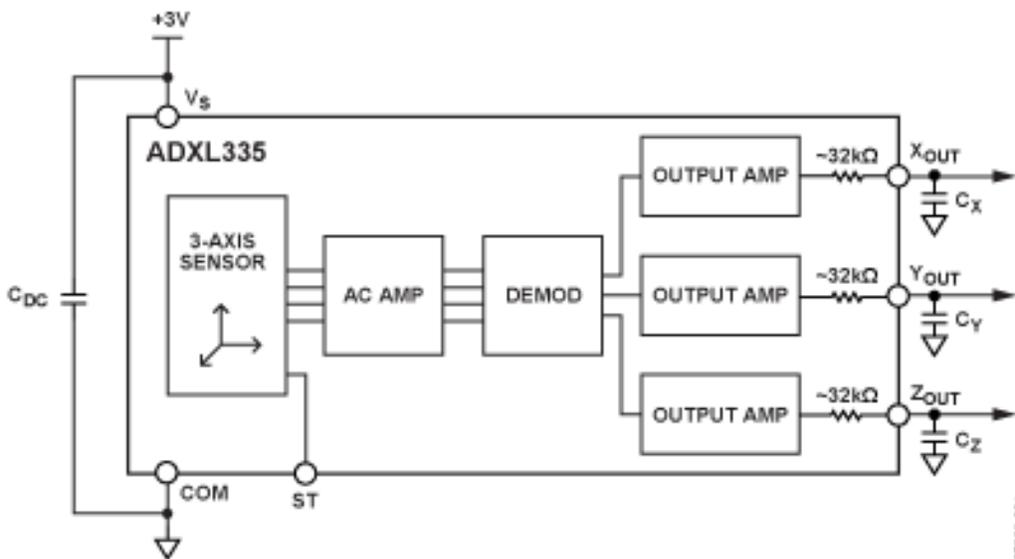
Figure 14: Circuit Diagram of Accelerometer

2.9.1.FEATURES:

- 3-axis sensing

- Small, low profile package

- 4 mm × 4 mm × 1.45 mm LFCSP

- Low power : 350 µA (typical)

- Single-supply operation: 1.8 V to 3.6 V

- 10,000 g shock survival

- Excellent temperature stability

- BW adjustment with a single capacitor per axis

- RoHS/WEEE lead-free compliant

2.9.2.APPLICATIONS:

- Cost sensitive, low power, motion- and tilt-sensing applications

- Mobile devices

- Gaming systems

- Disk drive protection

- Image stabilization

- Sports and health devices

2.10 HEARTBEAT SENSOR

Here we are using IR sensor for detecting the HEART BEAT. IR has less noise and ambient light than at normal optical wavelengths. The light is produced only when current passes through in the forward direction and block current in the reverse direction. Plethysmograph is an infrared photoelectric sensor used to record changes in pulsatile blood flow from the finger. The Plethysmograph operates by recording changes in blood volume as the arterial pulse expands and contracts the microvasculature.
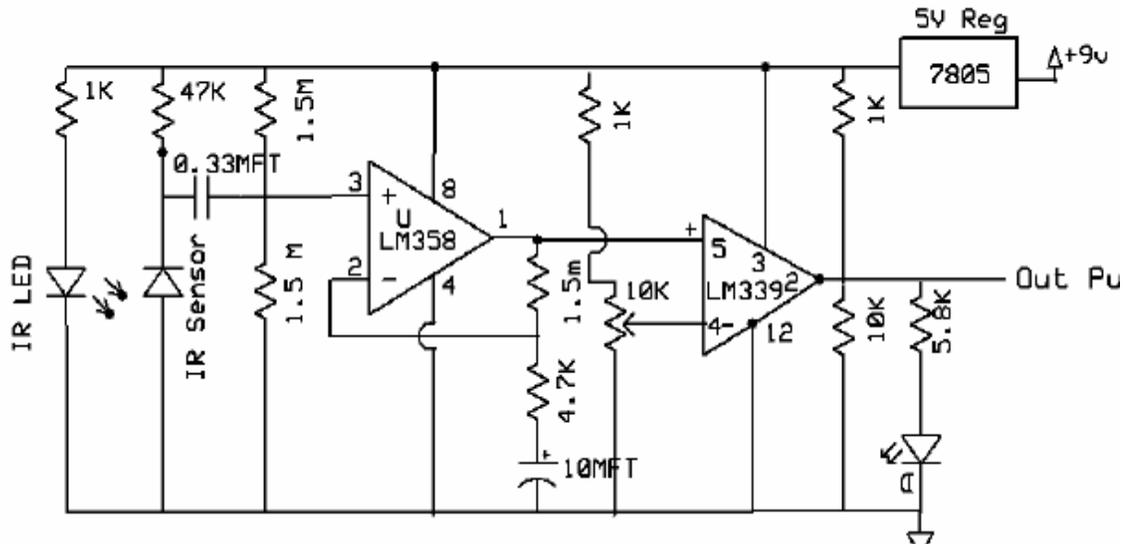
Figure 15: Circuit Diagram of Heart Beat Sensor

This is a non-invasive measurement for changes in finger blood flow during wakefulness and sleep. Pulse wave amplitude (PWA) is the most frequently used parameter obtained by finger plethysmography. PWA is directly and positively correlated to finger blood flow. The hypothesis of this study was that finger plethysmography detects pharmacologically induced changes in finger blood flow, in particular changes induced by stimulation and blockade of vascular a-receptors. Due to the anatomic structure of the finger we expected that alterations of vascular tone following sympathetic activation or inhibition might be reflected by changes of PWA. A change in finger blood flow, reflected by PWA is derived from the finger plethysmography. PWA derived from finger plethysmography allows continuous, noninvasive measurement of changes in finger blood flow during wakefulness and sleep. Finally, to demonstrate the ability of finger plethysmography to continuously monitor vascular tone, PWA responses to obstructive breathing and concomitant arousal events in patients with obstructive sleep apnea were recorded and analysed.

Figure 16: Graphical Image of Heart Beat Sensor

2.10.1Applications:

· Monitors pulse rate and rhythm.

• Alphanumeric LCD Display.

• Pulse monitoring by sound beeps and LED indication.

• Shows Pulse Rate per minute after every 5 pulse count. 10 or 15 pulse count average also selectable.

• Infra-Red Optical Finger /Ear Lobe Clip sensor.

• Bar Graph to display signal sensitivity.

• 15 Memories.

• Lightweight, Easy to handle, Simple operation.

• Works on power and battery both.

• Recommended for hospitals, small clinics, medical research centers

2.11 GSM MODULE

2.11.1.Features of SIm 300 Module

- Designed for global market, SIM300 is a Dual-band GSM/GPRS engine

- Works on frequencies EGSM 900 MHz, DCS 1800 MHz
- SIM300 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes
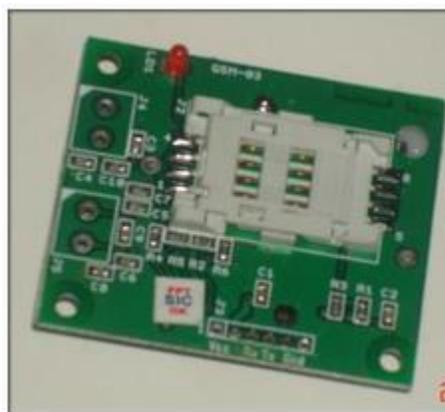
2.11.2.Feautures of GSM Kit

- This GSM modem is a highly flexible plug and play dual band GSM modem
- Supports features like Voice, Data/Fax, SMS,GPRS and integrated TCP/IP stack.
- Control via AT commands(GSM 07.07,07.05 and enhanced AT commands)
- Use DC Power 3.6 - 4.6 Volts Maximum

2.11.3.Package Contents

GSM Modem With TTL
Antenna Single stand Wire Antenna

Front Side   Back Side

CHAPTER 3

3.1 MPLAB IDE

DESCRIPTION

Integrated Development Environment (IDE) is an application that has multiple functions for software development. MPLAB IDE an executable program that integrates a compiler, an assembler, a project manager, an editor, a debugger, simulator, and an assortment of other tools within one Windows application. A user developing an application should be able to write code, compile, debug and test and application without leaving the MPLAB IDE desktop.

Bundled with MPLAB IDE software are several code generation tools. MPASM™ assembler is a full-featured universal macro assembler for all PICmicro MCUs. It can produce absolute code directly in the form of HEX files for device programmers, or it can generate relocatable objects for MPLINK™ linker. MPLINK™ linker links relocatable objects from assembly or C source files along with pre-compiled libraries using directives from a linker script, and supports MPASM™, MPLABC17, and MPLABC18. MPLIB™ librarian ia a librarian for pre-compiled code to be used with MPLINK™ linker.

When a routine from a library is called from another souce file, only the modules that contain that routine will be linked in with the application. This allows large libraries to be used efficiently in many different applications. The latest versions of MPASM™, MPLINK™, and MPLIB™ are bundled with MPLAB and can be downloaded separately by choosing the web install and selecting only the MPASM™, MPLINK™, and/or MPLIB™
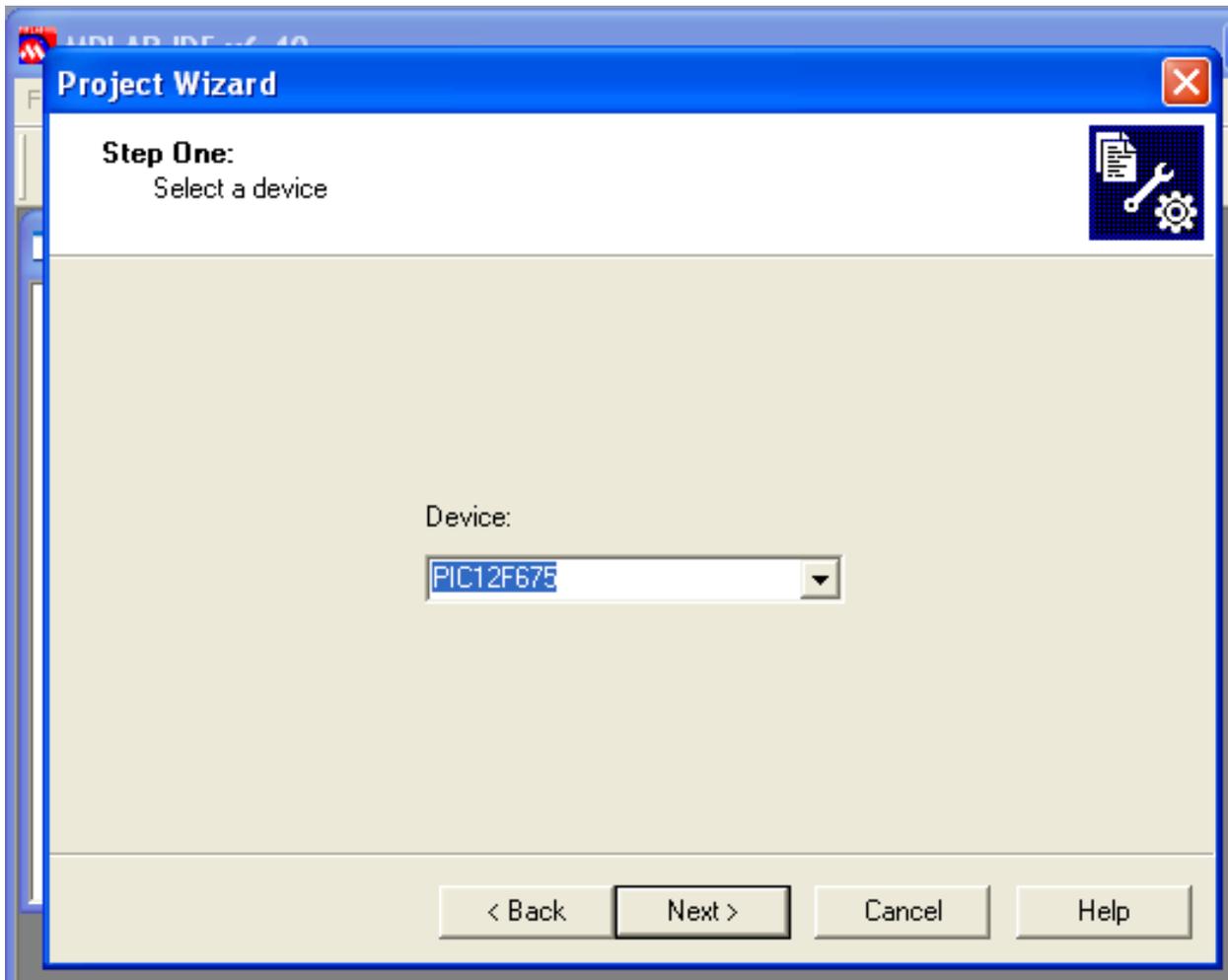
HOW TO USE

- Create a project

- Enter program

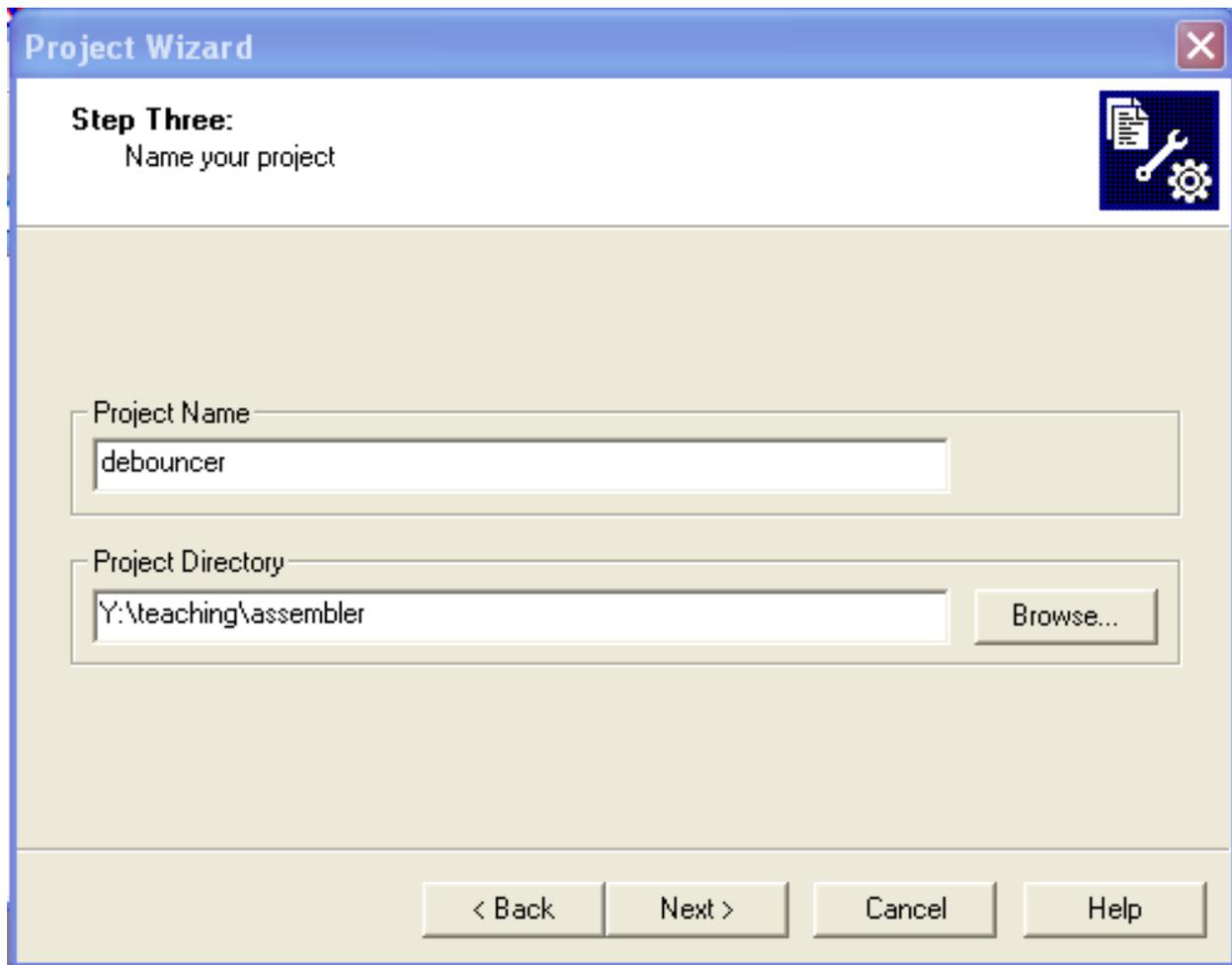- Assemble program

- Down load program

- Run program

- Simulate

STEP 1:CREATE NEW PROJECT
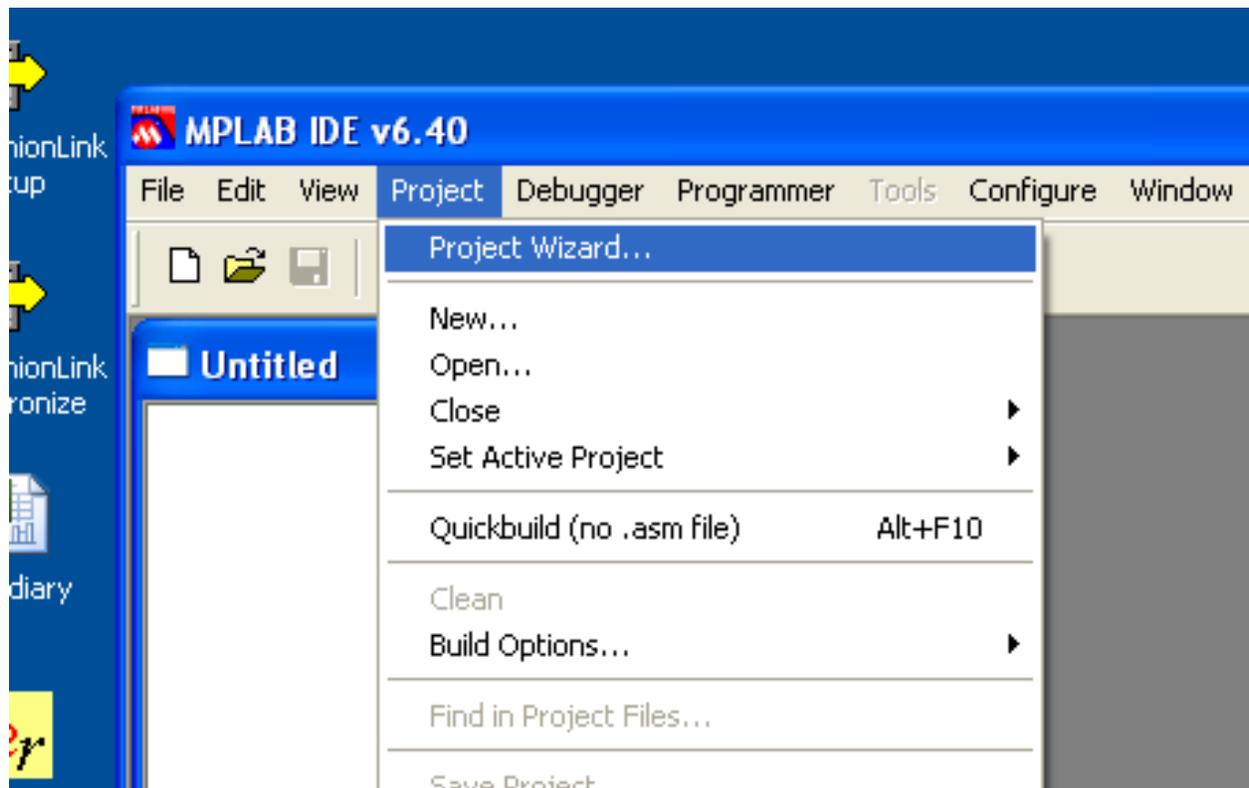
STEP 2 :SELECTING PIC TYPE

.

STEP 3: NAME YOUR PROJECT

STEP 4: TYPE THE PROGRAM

- Now click on File->New to get a new blank file

- Type in your program.

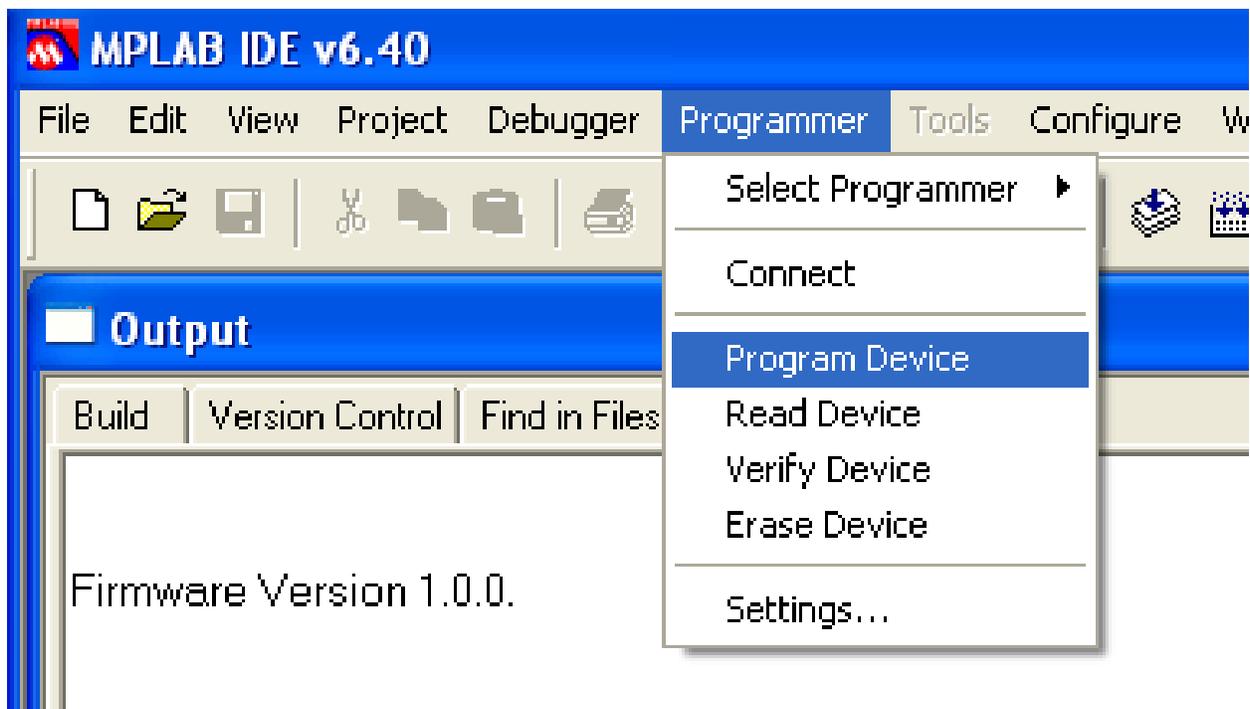## STEP 5: SAVE THE FILE:

- Once you have entered your program save it with the extension .asm

- At this point the syntax highlighting will switch on.

STEP 6:RUN THE ASSEMBLER

- Goto the project menu

- Select Build and correct the errors

STEP 7: PROGRAM THE CHIP

STEP 8:TEST ON BOARD

Test on the board by pressing the rest button

CHAPTER 4

4.1 APPLICATIONS

It provides a non invasive method for real time continuous monitoring of patient. It useful in understaffed hospitals. It used for remote monitoring by specialist doctors in longdistance and it can also be used for old people with other ailments required to be monitor

4.2 CONCLUSION:

This system helps ease the requirement for a person to always be present in coma .It also helps to record and analyse the behaviourial patterns and also the return of consciousness for the patient under study.The readingcan be sampled at about a hundered times a second to produce the output accurately.With little modification it can also be used to monitor particular signs for a specific patient.

4.3 BIBILOGRAPHY:

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