WE CARE AN INTELLIGENT MOBILE TELECARDIOLOGY SYSTEM TO ENABLE m-HEALTH APPLICATION

A PROJECT REPORT

Submitted by

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KUMARAGURU COLLEGE OF TECHNOLOGY

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BONAFIDE CERTIFICATE

Certified that this project report titled **"WE CARE AN INTELLIGENT MOBILE TELECARDIOLOGY SYSTEM TO ENABLE m-HEALTH APPLICATION"** is the bonafide work of "**BREEZY ROSELIN.S,DEEPA.K,KAVIYAPRIYA.D,LAVANYA.M"** who carried out the project work under my supervision.

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INTERNAL EXAMINER

EXTERNAL EXAMINER

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ABSTRACT

Recently, cardiovascular disease (CVD) has become one of the leading death causes worldwide and it contributes to 41% of all deaths per year in China. This disease incurs a cost of more than 400 billion US dollars in China on the healthcare expenditures during the past ten years. In this project the ECG abnormality condition of a patient is monitored by measuring the pulse rate using the 3 limb lead electrode system. These electrodes could be placed directly on the patient's skin and it is used for measuring the pulse rate of the patient. Pressure rate, temperature condition, humidity condition of a room can be measured by its corresponding sensors. Then the measured analog values are passed to PIC16F877A microcontroller in which those values are converted into digital values by ADC. These parameters are continuously monitored and send as SMS to the corresponding doctor and the patient's family by using the technology called GSM with the help of keypad. Then by checking these measured values any abnormality condition in the above parameters are carefully monitored and provide necessary health care to the patient. By this technology the death rate condition due to cardiac arrest can be avoided.

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LIST OF ABBREVIATIONS

GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communication
PDA	Personal Digital Assistant
RISC	Reduced Instruction Set Computer
EEPROM	Electrically Erasable Programmable Read Only Memory
SRAM	Static Random Access Memory
JTAG	Joint Test Access Group
LED	Light Emitting Diode
LCD	Liquid Crystal Display
VB	Visual Basic
IDE	Integrated Development Environment
API	Application Programmable Interface
ICS	In Circuit Simulators

CHAPTER 1

INTRODUCTION

WE-CARE is a wearable efficient telecardiology system, that can provide 24/7 health monitoring service with the help of wearable and mobile 3-lead wireless ECG sensor. As demonstrated by the clinical results, the WE-CARE system is a useful and efficient m-Health (mobile health) tool for the cardiovascular disease diagnosis and treatment in medical platforms. Recently, cardiovascular disease (CVD) has become one of the leading death causes worldwide and it contributes to 41% of all deaths each year in China. It has been shown that the CVD can be effectively prevented by an interdisciplinary approach that leverages the technology development in both IT and electrocardiogram (ECG) fields. It is difficult to implement a long-term monitor for each outpatient or home user due to limited medical resources. Recent advances in wireless mobile networking technologies have provided an opportunity to alleviate this problem; this concept is known as mobile health (m-Health).

In this project the ECG abnormality condition of a patient is monitored by measuring the pulse rate using the 3 limb lead electrode system that could be placed directly on the patient's skin. Leads aVR, aVL, and aVF are augmented limb leads. They are derived from the same three electrodes as leads I, II, and III. However, they view the heart from different angles (or vectors) because the negative electrode for these leads is a modification of Wilson's central terminal, which is derived by adding leads I, II, and III together and plugging them into the negative terminal of the EKG machine. Then this pulse rate measured through limb lead system is converted to ECG signal by fine tuning with the help of IC TL0741N, LM358, isolation IC, voltage regulator and filtering capacitor. It also monitor the pressure

rate of a patient by using pressure sensor, temperature condition of a patient by using temperature sensor and humidity condition of a room by using humidity sensor. Then the measured analog values are passed to PIC16F877A microcontroller in which those values are converted into digital values by ADC. These parameters are continuously monitored and send as SMS to the corresponding doctor and the patient family by using the technology called GSM with the help of keypad. So, by this technology any abnormality conditions in the above parameters are carefully monitored and provide necessary health care to the patient and also the death rate condition due to cardiac arrest can be avoided.

CHAPTER 2

PROJECT DESCRIPTION

2.1GENERAL BLOCK DIAGRAM

PIC microcontroller 16F877A has five ports. They are port A, port B, port C, port D, port E. Each port has eight pins. In this port A pins from RA0 to RA7 is used for analog signals which are measured from temperature sensor, humidity sensor, pressure sensor and heart rate sensor.RB0 to RB7 which is used for digit l input such as keypad. port C pins RC6 to RC7 is used for keypad. port B pins from RB0 to RB7 is used for LCD display.

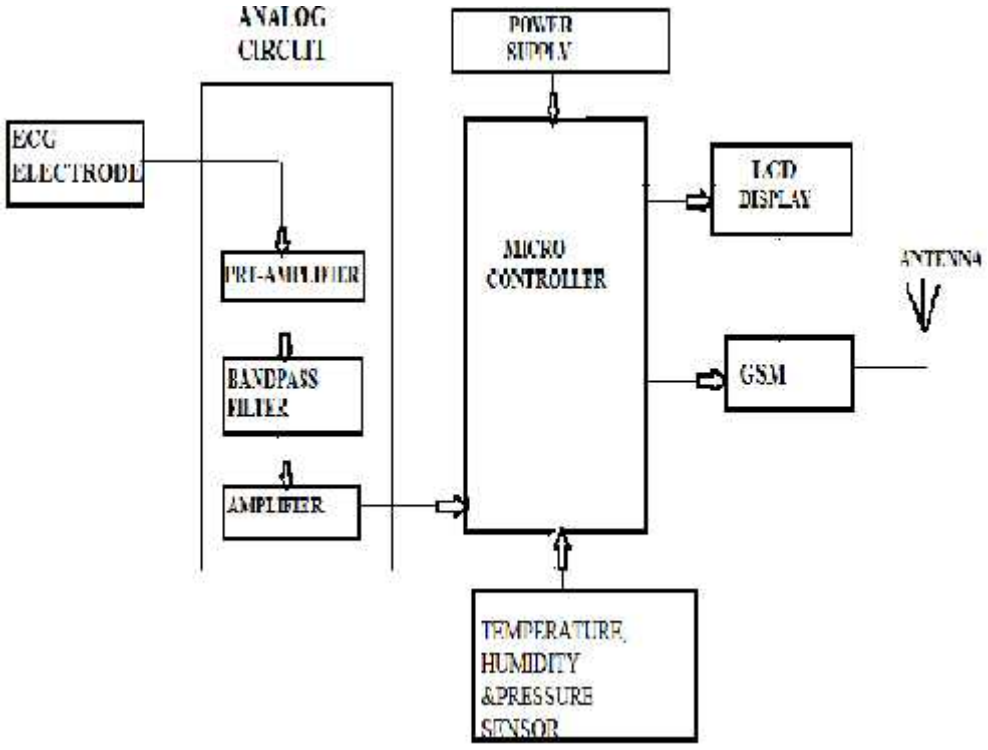


Fig1-TRANSMITTER SECTION

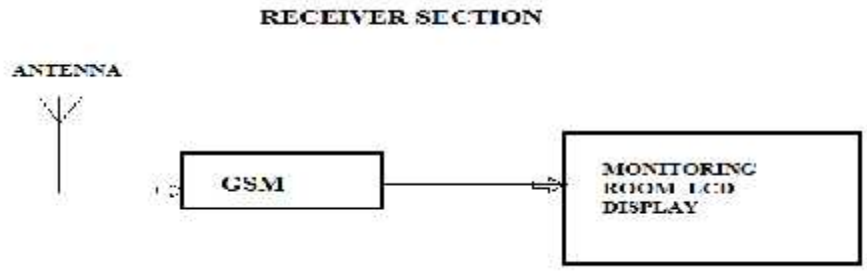


Fig2-RECEIVER SECTION

PIC16F877A,in which PIC stands for Peripheral Interface Controller,16 stands for mid range family, F stands for flash memory,8 stands for 8-bit controller,77 is the version, A stands for advanced. It has 40 pins, where pin 11 and 33 are used for VCC, pin 12 and 34 are used for ground connection. The program can be interfaced to PIC microcontroller through top win programmer. In the above block diagram by using ECG electrode the pulse rate of the patient is measured, which is measured as analog value and its value is further amplified by pre-amplifier. Band pass filter is used to acquire the required bandwidth of frequencies to measure the abnormalities and its values further amplified and given as input to port A. In the pin description of PIC 16F877A it is mentioned that port A is used for analog signals.PIC16F877A has 8 channels of 10 bit analog to digital converter.

The analog to digital conversion is based on ADCON. Hence the measured pulse rate values are converted from analog to digital value. This procedure is same for temperature, humidity and pressure values which are measured by its corresponding sensor. Here the program is written for the condition if the heart beat exceeds 120 beats/min the abnormality condition is alerted in monitor room which is provided with LCD Display and for temperature sensor if it exceeds 30 degree Celsius abnormality is shown. These all the above parameters are measured as analog value which are converted into digital value using ADC on

PIC16F877A.The ADCON register decides which pin is used as ADC. Here port A is used for this purpose. The converted digital value of the above parameter is shown in LCD Display .At the same time it is send as message to monitor room using GSM technology through antenna. At the receiver side section the message is received through GSM by using antenna .Periodically the message is stored in monitor room. If any abnormalities are found in the above measured parameters like heartbeat rate, temperature and pressure values it is alerted in monitor room along with LCD Display.

2.2SOFTWARE REQUIREMENTS

Visual basic

Embedded c for coding

Proteus software

2.3HARDWARE REQUIREMENTS

Power supply 12V	-	Transformer, Rectifier, Filter
Microcontroller	-	PIC 16F877A
Voltage regulator	-	IC 7805

ECG monitoring

Heart beat sensor

GSM Module

LCD display

Pressure and humidity sensor

CHAPTER 3

SENSORS

3.1 ECG MONITORING

3.1.1Electrocardiogram:

An electrocardiogram (ECG or EKG, abbreviated from the German Elektrokardiogramm) is a graphic produced by an electrocardiograph, which records the electrical activity of the heart over time. Analysis of the various waves and normal vectors of depolarization and repolarisation yields important diagnostic information.

It is the gold standard for the evaluation of cardiac arrhythmia. It guides therapy and risk stratification for patients with suspected acute myocardial infarction. It helps to detect electrolyte disturbances (e.g. hyperkalemia and hypokalemia) .It allows for the detection of conduction abnormalities (e.g. right and left bundle branch block) .It is used as a screening tool for ischemic heart disease during a cardiac stress test. It is occasionally helpful with non-cardiac diseases (e.g. pulmonary embolism or hypothermia) .The electrocardiogram does not assess the contractility of the heart. However, it can give a rough indication of increased or decreased contractility. Block diagram of ECG monitoring shown in fig1.

ECG on graph paper:

A typical electrocardiograph runs at a paper speed of 25 mm/s, although faster paper speeds are occasionally used. Each Small block of ECG paper is 1 mm^2. At a paper speed of 25 mm/s, one Small block of ECG paper translates into 0.04 s (or 40 ms). Five Small blocks make up 1 large block, which translates into 0.20 s (or

200ms). Hence, there are 5 large blocks per second. A diagnostic quality 12 lead ECG is calibrated at 10 mm/mV. Fig 3 shows the graph of ECG waveform.

Fig3-ECG waveform

3.1.2 FILTER SECTION

Modern ECG monitors offer multiple filters for signal processing. The most common settings are monitor mode and diagnostic mode. In monitor mode, the low frequency filter (also called the high-pass filter because signals above the threshold are allowed to pass) is set at either 0.5 Hz or 1 Hz and the high frequency filter (also called the low-pass filter because signals below the threshold are allowed to pass) is set at 40 Hz. This limits artifact for routine cardiac rhythm monitoring. The low frequency (high-pass) filter helps reduce wandering baseline and the high frequency (low pass) filter helps reduce 60 Hz power line noise. In diagnostic mode, the low frequency (high pass) filter is set at 0.05 Hz, which allows accurate ST segments to be recorded. The high frequency (low pass) filter is set to 40, 100, or 150 Hz. Consequently, the monitor mode ECG display is more filtered than diagnostic mode, because its band pass is narrower. Fig 5 shows the filtering section and block diagram of ECG monitoring system.

3.1.3 LIMB LEAD SYSTEM

Leads I, II and III are the so-called limb leads because at one time, the subjects of electrocardiography had to literally place their arms and legs in buckets of salt water in order to obtain signals for Einthoven's string galvanometer. They form the basis of what is known as Einthoven's triangle. Eventually, electrodes were invented that could be placed directly on the patient's skin. Even though the buckets of salt water are no longer necessary, the electrodes are still placed on the patient's arms and legs to approximate the signals obtained with the buckets of salt water. They remain the first three leads of the modern 12 lead ECG.In fig4 it is shown that Lead I is a dipole with the negative (white) electrode on the right arm and the positive (black) electrode on the left arm. Lead II is a dipole with the negative (white) electrode on the right arm and the positive (red) electrode on the left leg. Lead III is a dipole with the negative electrode (black) on the left arm and the positive (red) electrode on the left leg.

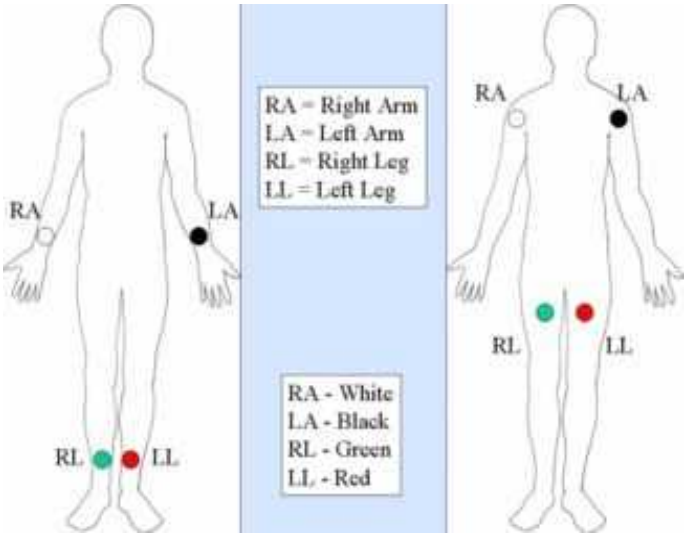


Fig4-Limb lead system

Leads aVR, aVL, and aVF are augmented limb leads. They are derived from the same three electrodes as leads I, II, and III. However, they view the heart from different angles (or vectors) because the negative electrode for these leads is a modification of Wilson's central terminal, which is derived by adding leads I, II, and III together and plugging them into the negative terminal of the EKG machine. This zeroes out the negative electrode and allows the positive electrode to become the "exploring electrode" or a unipolar lead. This is possible because Einthoven's Law states that I + (-II) + III = 0. The equation can also be written I + III = II. It is written this way (instead of I + II + III = 0) because Einthoven reversed the polarity of lead II in Einthoven's triangle, possibly because he liked to view upright QRS complexes. Wilson's central terminal paved the way for the development of the augmented limb leads aVR, aVL, aVF and the precordial leads V1, V2, V3, V4, V5, and V6.Lead aVR or "augmented vector right" has the positive electrode (white) on the right arm.

The negative electrode is a combination of the left arm (black) electrode and the left leg (red) electrode, which "augments" the signal strength of the positive electrode on the right arm. Lead aVL or "augmented vector left" has the positive (black) electrode on the left arm. The negative electrode is a combination of the right arm (white) electrode and the left leg (red) electrode, which "augments" the signal strength of the positive electrode on the left arm.Lead aVF or "augmented vector foot" has the positive (red) electrode on the left leg. The negative electrode is a combination of the right arm (white) electrode and the left arm (black) electrode, which "augments" the signal of the positive electrode on the left leg.

The augmented limb leads aVR, aVL, and aVF are amplified in this way because the signal is too small to be useful when the negative electrode is Wilson's

central terminal. Together with leads I, II, and III, augmented limb leads aVR, aVL, and aVF is used.

3.1.4 BLOCK DIAGRAM OF ECG

In fig4, there are three electrodes used to measure the ECG waves in which two electrodes are fixed with left and right hand another one electrode is fixed in the right leg which acts as reference ground electrode. Electrode 1 and Electrode 2 pick up the ECG waves from the both hands. Then the ECG waves are given to instrumentation amplifier section. The instrumentation amplifier is constructed by the TL 072 operational amplifier. The TL072 are high speed J-FET input dual operational amplifier incorporating well matched, high voltage J-FET and bipolar transistors in a monolithic integrated circuit. The circuit diagram is shown in fig5.

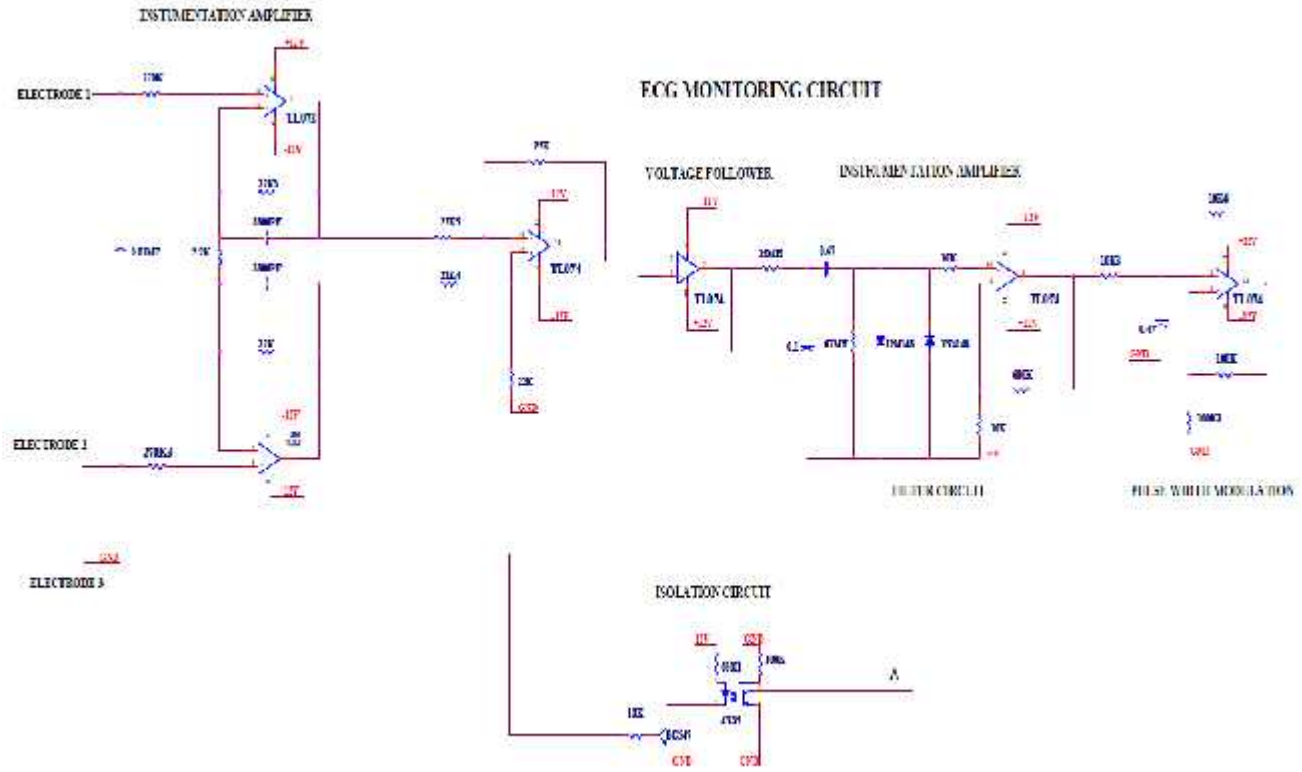


Fig5- ECG monitoring unit

3.1.5 PULSE RATE MONITORING SYSTEM

A heart rate monitor is a personal monitoring device that allows one to measure one's heart rate in real time or record the heart rate for later study. It is largely used by performers of various types of physical exercise.

3.1.6 Schematic diagram of pulse rate monitoring system

Principle of Heartbeat Sensor

The heartbeat sensor is based on the principle of photo phlethysmography. It measures the change in volume of blood through any organ of the body which

causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

There are two types of photophlethysmography:

Transmission: Light emitted from the light emitting device is transmitted through any vascular region of the body like earlobe and received by the detector.

Reflection: Light emitted from the light emitting device is reflected by the regions.

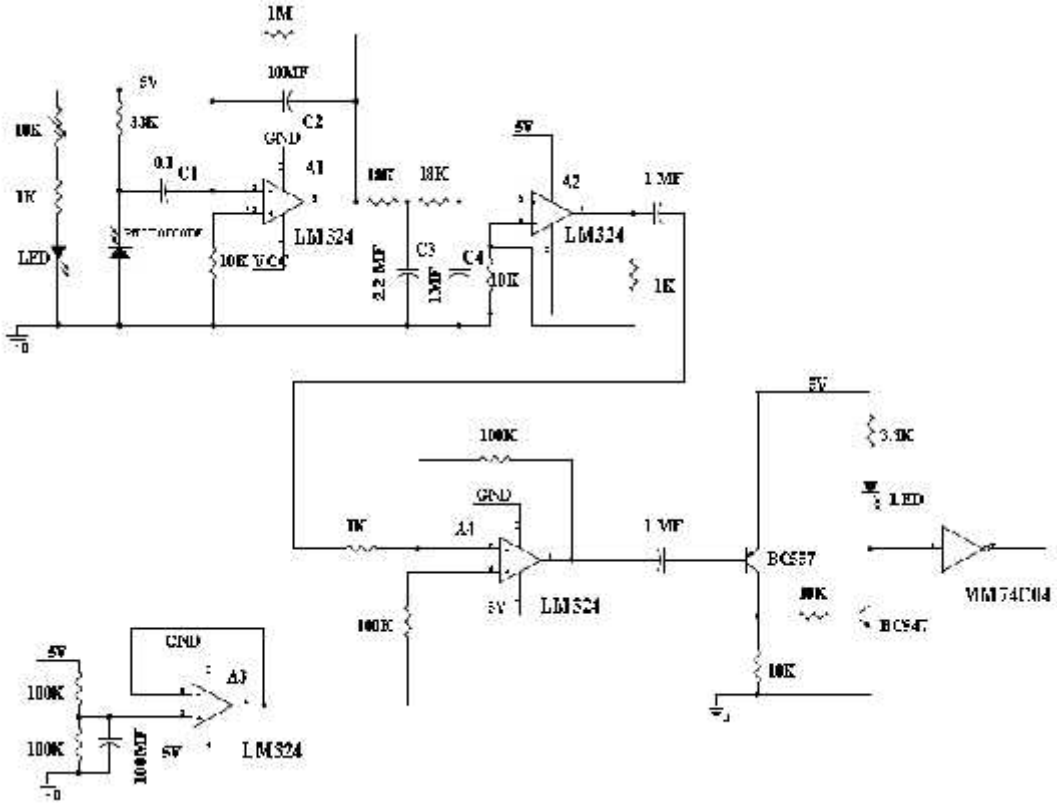


Fig 6- schematic diagram of pulse rate monitoring system

FEATURES OF PULSE RATE MONITORING SYSTEM

In LM324 amplifier, supply voltage is given to pin1.pin2 and 3 is given to ground and pin4 is given to the output, which is shown in fig6.It is shown that the sensor unit consists of an infrared light-emitting-diode (IR LED) and a photo diode, placed side by side, and the fingertip is placed over the sensor assembly. The IR LED transmits an infrared light into the fingertip, a part of which is reflected back from the blood inside the finger arteries. The photo diode senses the portion of the light that is reflected back. The intensity of reflected light depends upon the blood volume inside the fingertip. So, every time the heart beats the amount of reflected infrared light changes, which can be detected by the photo diode. With a high gain amplifier, this little alteration in the amplitude of the reflected light can be converted into a pulse.

Advantages

Heart rate monitors are potentially life-saving devices for those with health conditions that put them at high risk of heart attack.

3.2 PRESSURE SENSOR

A pressure sensor measures pressure, typically of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed. Pressure sensors are used for control and monitoring the thousands of everyday applications. Pressure sensors can alternatively be called pressure transducers, pressure transmitters, pressure senders, pressure indicators, piezometers and manometers, among other names. Its schematic diagram is shown in fig7.

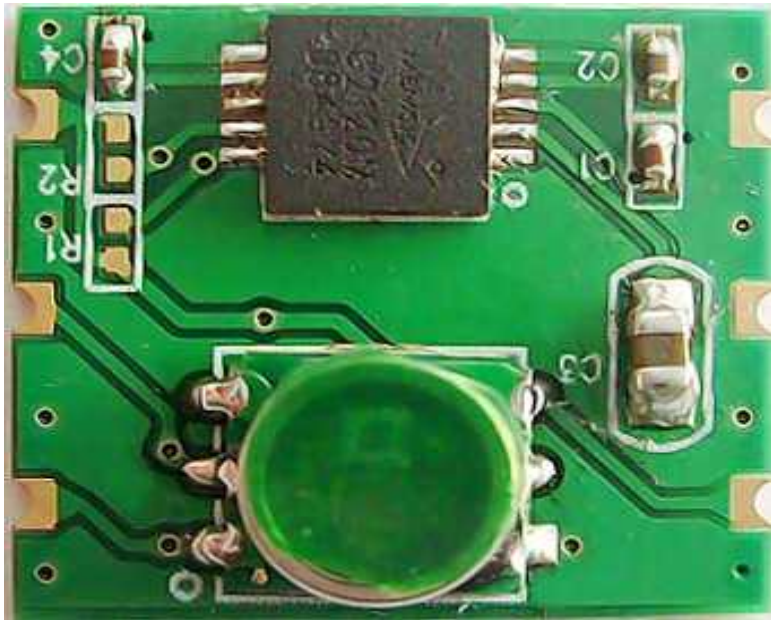


Fig7-Schematic diagram of pressure sensor

Features of pressure sensor

Important features are Integrated pressure sensor,300-1100hpa absolute Pressure Range ,11 coefficients for software compensation ,Power up/down function available through I2C interface ,2.4V~5.25V wide power supply operation supported ,Supply voltage 2.2v-3.6v ,-20°C to + 60°C operating range ,No external components required ,I2C digital output with 400 KHz, fast mode operation.

Applications

Pressure measurement and control systems, Mobile altimeter/barometer systems, Weather forecast product.

3.3 HUMIDITY SENSOR

DF Robot's latest generation of digital Temperature and Humidity sensor is as powerful as it used to be but easier to use. DHT11 has a full range temperature compensation, low power consumption, long term stability and calibrated digital signal. A high-performance 8-bit microcontroller is integrated in the sensor with calibration-coefficient saved in OTP memory to provide accurate temperature readings. Its schematic diagram is shown in fig8.

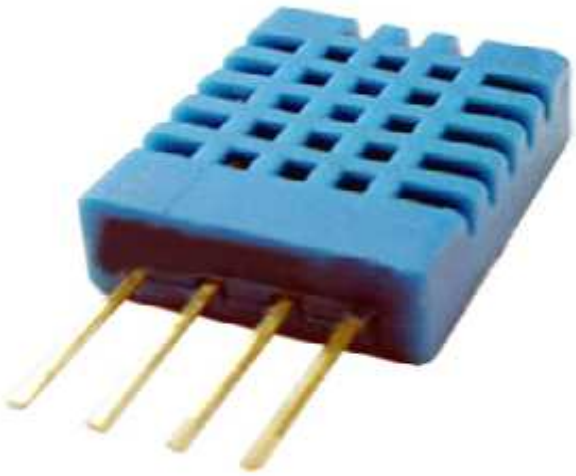


Fig8-Schematic diagram of humidity sensor

Specification

Temperature range: 0-50 °C error of ± 2 °C, Humidity: 20-90% RH ± 5% RH error, Interface: Digital, Wider voltage range: 3.3V to 5V.

Applications

Relative humidity and temperature measurement, all calibration, digital output, excellent long-term stability, completely interchangeable.

CHAPTER 4
PIC MICROCONTROLLER

4.1 PIC

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip:

- The CPU core
- Memory(both ROM and RAM)
- Some parallel digital i/o

Microcontrollers will combine other devices such as:

A timer module allows the microcontroller to perform tasks for certain time periods. A serial I/O port allows data to flow between the controller and other devices such as a PIC or another microcontroller. ADC is used to allow the microcontroller to accept analog input data for processing.

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complimentary metal oxide semiconductor) that uses separate bus for instruction and data allowing Simultaneous access of program and data memory.

PIC (16F877A)

Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in PIC 16F877A is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877A.Its architecture is shown in fig9.

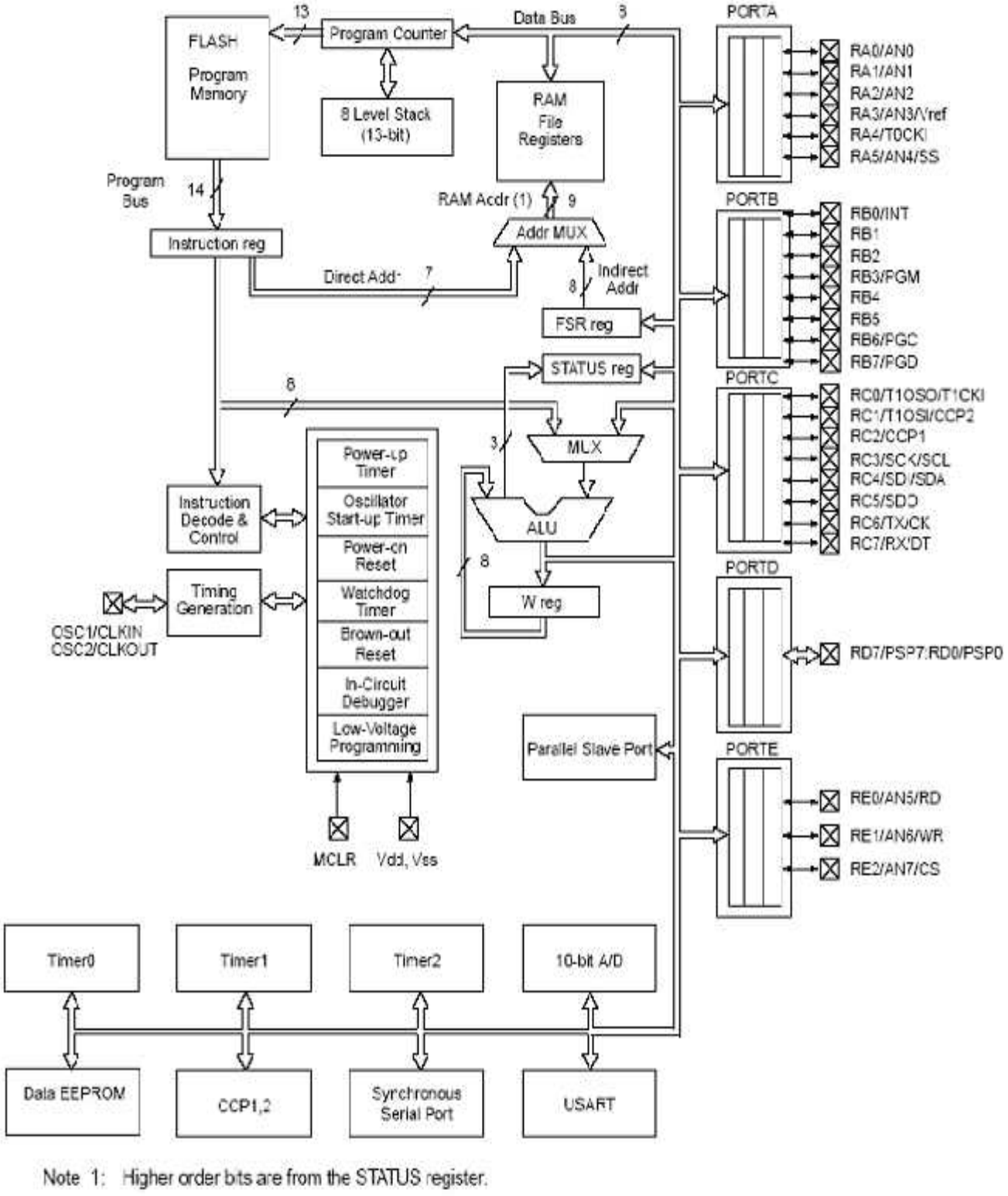
4.2 CORE FEATURES:

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 PIC16C73/74/76/77,Interrupt capability (up to 14 internal/external),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 EPROM/EEPROM technology, Fully static design, In-Circuit Serial Programming (ICSP) via two pins, Only single 5V source needed for programming capability, In-Circuit Debugging via two pins, Processor read/write access to program memory, Wide operating voltage range: 2.5V to 5.5V,High Sink/Source Current: 25mA Commercial and Industrial temperature ranges, Low-power consumption. Its core features is shown in fig9.

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, 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. Brown-out detection circuitry for Brown-out Reset (BOR).Its peripheral features is shown in fig9.

4.3 ARCHITECTURE OF PIC



Note 1: Higher order bits are from the STATUS register.

Fig9-Architecture of PIC

PIN DIAGRAM OF PIC 16F877:

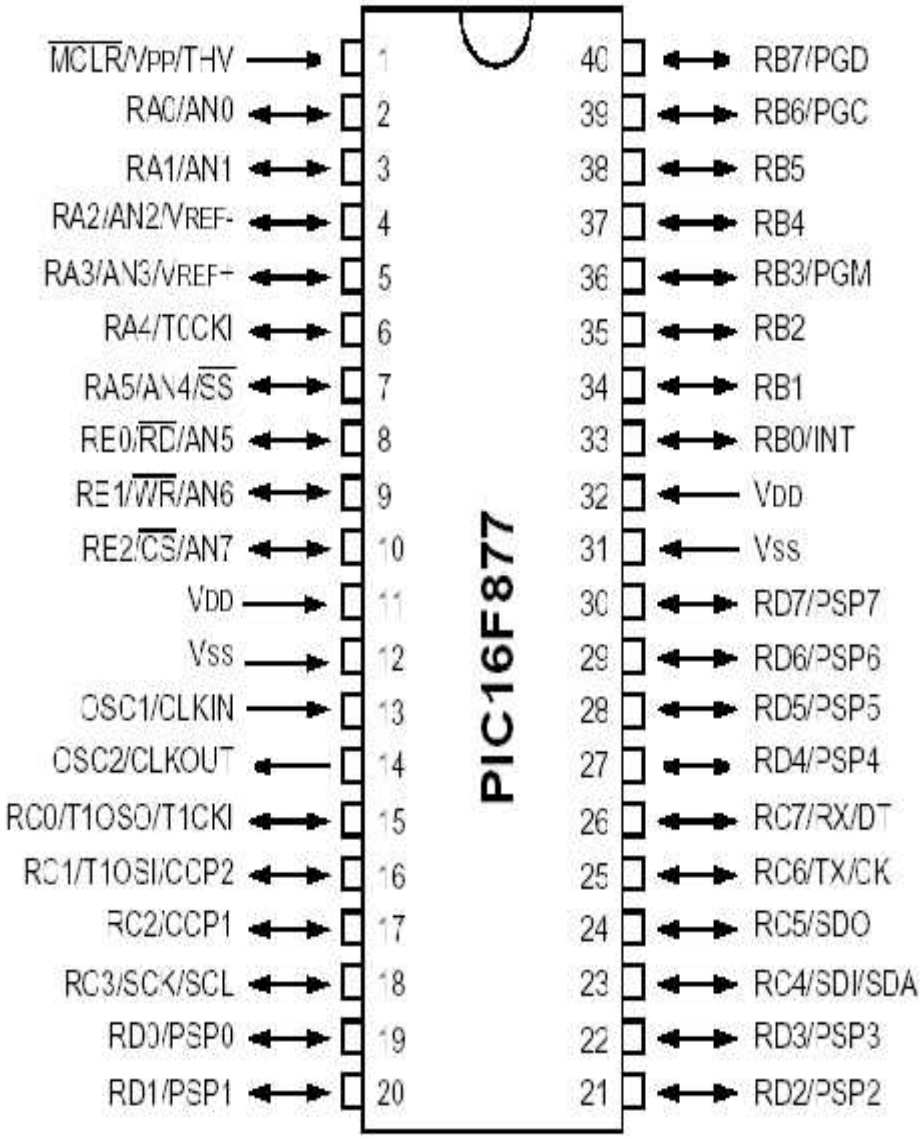


Fig10-Pin diagram of PIC16F877

Pin description:

It has five ports. They are port A, port B, port C, port D, port E. Each port has eight pins. In this, port A pins from RA0 TO RA7 is used for analog signals which is measured by temperature sensor, humidity sensor, pressure sensor and heart rate sensor.RB0 to RB7 is used for digit l input such as keypad. Then port C pins RC6 to RC7 is used for keypad. Then port B pins from RB0 to RB7 is used for LCD display. PIC16F877A,in this PIC stands for Peripheral Interface Controller,16 stands for mid range family, F stands for flash memory,8 stands for 8-bit controller,77 is the version, A stands for advanced. It has 40 pins, where pins 11 and 33 are used for VCC, pins 12 and 34 are used for ground connection. The program can be interfaced to PIC microcontroller through topwin programmer. The pin diagram for PIC16F877A is shown in fig10.

4.5 KEY PAD

A group of keys in a single printed circuit board is call key pad. These key pads are classified into two types.

1) Key pad
2) Matrix keypad

Key pad has one key or more than one key which are placed in a PCB and all the keys are commonly grounded. This is the main difference compared to matrix keypad. This key pad has maximum 8 numbers of keys. More than 8 keys cannot be connected because it’s not efficient. If there is need for more than 8 keys, then it can be operated only in matrix keypad.

Matrix keypad

Above same keys are connected in a matrix principle it is called as a matrix key pad. This matrix key pad is working with the help of software. Otherwise it cannot work. This key pad is normally 3X3, 4X3, 4X4 like that.Its schematic diagram is shown in fig11.

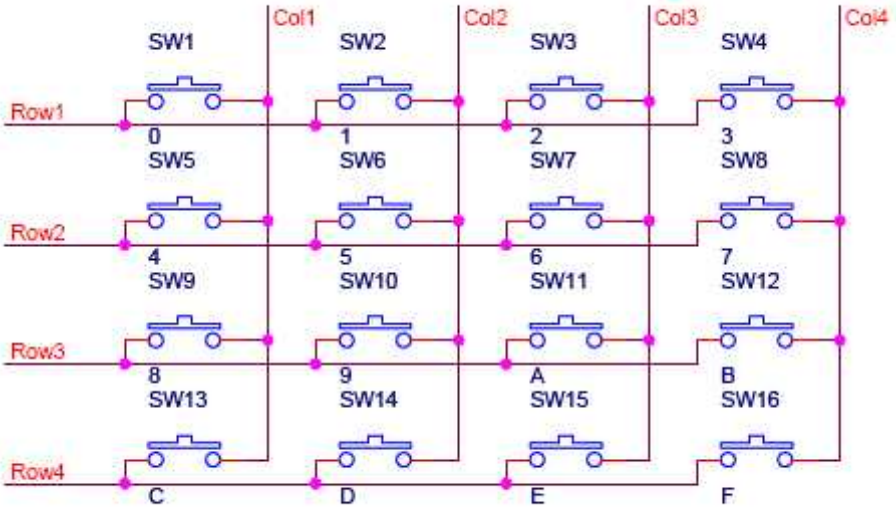


Fig11- matrix keypad

Schematic explanation

In order for the microcontroller to scan the keypad, it outputs a nibble to force one (only one) of the columns low and then reads the rows to see if any buttons in that column have been pressed. The rows are pulled up by the internal weak pull-ups in the 8051 ports. Consequently, as long as no buttons are pressed, the microcontroller sees logic high on each of the pins attached to the keypad rows. The nibble driven onto the columns always contains only a single 0. The only way the microcontroller can find a 0 on any row pin is for the keypad button to be pressed that connects the column set to 0 to a row. The controller knows which

column is at a 0-level and which row reads 0, allowing it to determine which key is pressed. For the keypad, the pins from left to right are: R1, R2, R3, R4, C1, C2, C3, and C4.

KEY DIMENSIONS:

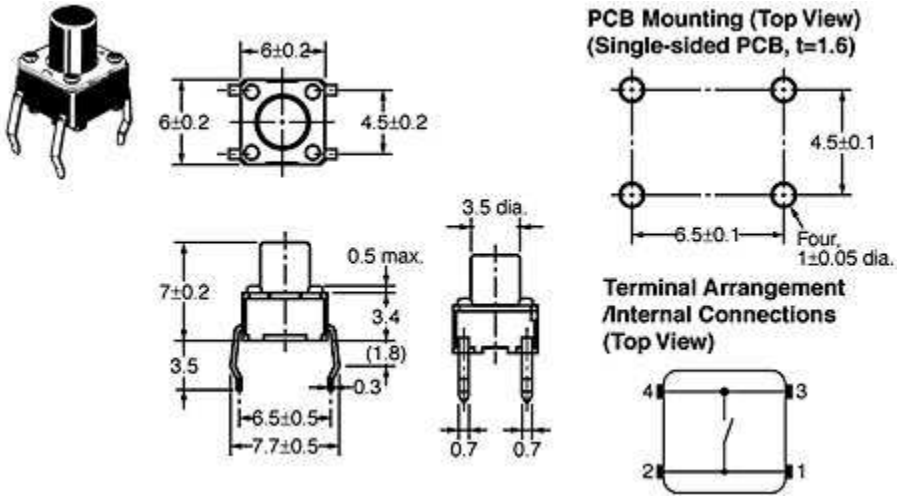


Fig12-key dimension

APPLICATION:

Basically key pad is a number of buttons compiled in such a manner so that it forms formation of numerous button and some other menus.The key dimensions are shown in fig12. Following is example configuration of key pad. Keypad needed to interaction with system, for example we make setting with set-point would a control feedback at the time of program still run. Actually every programmer has a different way of interaction with the system.

CHAPTER 5

GSM MODEM

GSM module

This is a plug and play GSM Modem with a simple serial interface, used to send SMS, make and receive calls, and do other GSM operations by controlling it through simple AT commands from micro controllers and computers. It uses the highly popular SIM300 module for all its operations. It comes with a standard RS232 interface which can be used to easily interface the modem to micro controllers and computers.GSM module is shown in fig13.

Fig13-GSM module

5.1 Features of GSM modem

Uses the extremely popular SIM300 GSM module, provides the industry standard serial RS232 interface for easy connection to computers and other devices, provides serial TTL interface for easy and direct interface to microcontrollers ,power, ring and network leads for easy debugging ,onboard 3v lithium battery holder with appropriate circuitry for providing backup for the modules internal RTC ,can be used for GSM based voice communications, data/fax, SMS,GPRS and TCP/IP stack ,can be controlled through standard at commands ,module's operation mode can be controlled through the power switch connected to the power pin (refer the SIM300 datasheet for more information) ,comes with an onboard wire antenna for better reception. Board provides an option for adding an external antenna through an SMA connector, SIM300 allows an adjustable serial baud rate from 1200 to 115200 bps (9600 default), modem a low power consumption of 0.25A during normal operations and around 1A during transmission, operating voltage: 7 – 15v ac or dc (board has onboard rectifier).

5.2 Working of GPS system

A GPS receiver "knows" the location of the satellites because that information is included in the transmitted Ephemeris data. By estimating how far away a satellite is, the receiver also "knows" it is located somewhere on the surface of an imaginary sphere centred at the satellite. It then determines the sizes of several spheres, one for each satellite and therefore knows the receiver is located where these spheres intersect.

GPS satellites transmit two radio signals. These are designated as L1 and L2. A Civilian GPS uses the L1 signal frequency (1575.42 MHz) in the UHF band. The

Signals travel by line of sight, meaning they will pass through clouds, glass, plastic etc but will not travel through solid objects such as buildings and mountains.

Advantages of GSM modem

Ultra small size (22x22x3 mm), lightweight (3.2 g) and easy to integrate, Low power consumption, R&TTE type approval plus CE, GCF, FCC, PTCRB, IC, Full RS232 on CMOS level with flow control (RX, TX, CTS, RTS, CTS, DTR, DSR, DCD, RI),Embedded TCP/IP Stack UDP/IP Stack , Embedded FTP and SMTP Client, High performance on low price.

GSM Supplementary Services

Call Barring and Call Forwarding, Advice of Charge, Call Waiting and Call Hold, Calling Line Identification Presentation (CLIP), Calling Line Identification Restriction (CLIR) Unstructured SS Mobile Originated Data (USSD), Closed User Group.

Audio

Telephony and emergency calls (Half Rate (HR), Full Rate (FR), and Enhanced Full Rate (EFR)), Echo cancellation and noise reduction, DTMF, Handset operations and basic hands free operation.

SMS

SMS Mobile Originated (MO), Mobile Terminated (MT) and Cell Broadcast (CB - DRX).

CHAPTER 6

SOFTWARE DESCRIPTION

6.1 VISUAL BASIC

Visual Basic is a third-generation event-driven programming language and integrated development environment(IDE) from Microsoft for its COM programming model first released in 1991. Microsoft intended Visual Basic to be relatively easy to learn and use. Visual Basic was derived from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data Access Objects, Remote Data Objects, or ActiveX Data Objects, and creation of ActiveX controls and objects.

Language features:

Like the BASIC programming language, Visual Basic was designed to accommodate a steep learning curve. Programmers can create both Simple and complex GUI applications. Programming in VB is a combination of visually arranging components or controls on a form, specifying attributes and actions for those components, and writing additional lines of code for more functionality. Since VB defines default attributes and actions for the components, a programmer can develop a Simple program without writing much code. Programs built with earlier versions suffered performance problems, but faster computers and native code compilation has made this less of an issue.

Visual Basic can create executables (EXE files), ActiveX controls, or DLL files, but is primarily used to develop Windows applications and to interface database systems. Dialog boxes with less functionality can be used to provide pop-up capabilities. Controls provide the basic functionality of the application, while programmers can insert additional logic within the appropriate event handlers. For example, a drop-down combination box automatically displays a list. When the user selects an element, an event handler is called that executes code that the programmer created to perform the action for that list item.

Alternatively, a Visual Basic component can have no user interface, and instead provide ActiveX objects to other programs via Component Object Model (COM). This allows for server-side processing or an add-in module. The runtime recovers unused memory using reference counting, which depends on variables passing out of scope or being set to nothing, avoiding the problem of memory leaks common to other languages. There is a large library of utility objects and the language provides basic object oriented support. Unlike many other programming languages, Visual Basic is generally not case sensitive—though it transforms keywords into a standard case configuration and forces the case of variable names to conform to the case of the entry in the symbol table. String comparisons are case sensitive by default.

The Visual Basic compiler is shared with other Visual Studio languages (C, C++). Nevertheless, by default the restrictions in the IDE do not allow creation of some targets (Windows model DLLs) and threading models, but over the years, developers have bypassed these restrictions.

PERFORMANCE

Visual Basic applications require Microsoft Visual Basic runtime MSVBVMxx.dll where xx is the relevant version number, either 50 or 60. MSVBVM60.dll comes as standard with Windows in all editions after Windows 98 while MSVBVM50.dll comes with all editions after Windows 95. A Windows 95 machine would however require inclusion with the installer of whichever DLL was needed by the program. Visual Basic 5 and 6 can compile code to either native or P-Code but in either case the runtime is still required for built in functions and forms management.

6.2 EMBEDDED C PROGRAMMING LANGUAGE

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires non standard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere it. It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing.

Embedded C uses most of the syntax and semantics of standard C e.g., main () function, variable definition, data type declaration, conditional statements (if, switch, case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, etc.

ALGORITHM

1.Start the program.

2. If the set key is pressed,then the mobile number will be saved.

3.Then it checks the condition,whether mode1 or mode2 is enabled.

4.If mode1 is enabled then the heart beat rate,temperature and pressure values are checked and displayed in LCD display.If the condition fails then again it checks whether mode1 is enabled or not.

5.If the condition succeeds,it will check whether the SMS mode is enabled or not.

6.If the SMS mode is enabled,the message which contains the measured values from heart beart,temperature and pressure sensors will be sent to the saved number.

7.If the mode is not enabled again it will check the condition of heart beat rate,temperature and pressure values which are displayed.

8.If mode2 is enabled it will check for the ECG signal and send the data to PC.

9.Stop the program.

Advantage

It is small and Simpler to learn, understand, program and debug compared to assembly language, C code written is more reliable and scalable, more portable between different platforms. C compilers are available for almost all embedded devices in use today, and there is a large pool of experienced C programmers. Unlike assembly, C has advantage of processor-independence and is not specific to any particular microprocessor/microcontroller or any system. This makes it

convenient for a user to develop programs that can run on most of the systems. As C combines functionality of assembly language and features of high level languages, C is treated as a 'middle-level computer language' or 'high level assembly language'.

6.3 RS232 COMMUNICATION

In telecommunications, RS-232 is a standard for serial communication transmission of data. It formally defines the signals connecting between a DTE (data terminal equipment) such as a computer terminal, and a DCE (data circuit-terminating equipment, originally defined as data communication equipment such as a modem. The RS-232 standard is commonly used in computer serial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pin out of connectors.

An RS-232 serial port was once a standard feature of a personal computer, used for connections to modems, printers, mice, data storage, uninterruptible power supplies, and other peripheral devices. However, RS-232 is hampered by low transmission speed, large voltage swing, and large standard connectors. In modern personal computers, USB has displaced RS-232 from most of its peripheral interface roles. Many computers do not come equipped with RS-232 ports and must use either an external USB-to-RS-232 converter or an internal expansion card with one or more serial ports to connect to RS-232 peripherals. RS-232 devices are widely used, especially in industrial machines, networking equipment and scientific instruments. Its structure is shown in fig14.

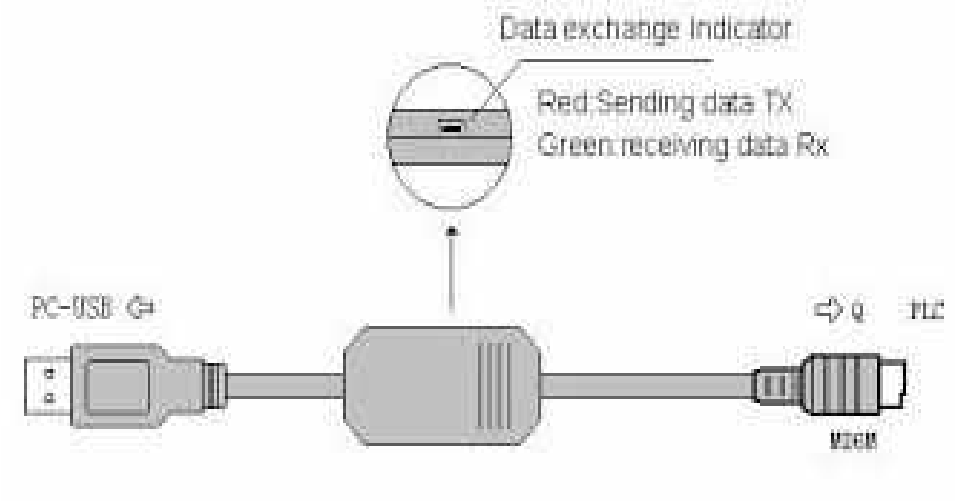


Fig14-Structure of RS232 Communication

SCOPE OF STANDARDS

Eelectrical signal characteristics such as voltage levels, signaling rate, timing and slew-rate of signals, voltage withstand level, short-circuit behavior, and maximum load capacitance. Interface mechanical characteristics, pluggable connectors and pin identification, functions of each circuit in the interface connector, standard subsets of interface circuits for selected telecom applications.

The standard does not define such elements as the character encoding or the framing of characters, or error detection protocols. The character format and transmission bit rate are set by the serial port hardware which may also contain circuits to convert the internal logic levels to RS-232 compatible signal levels. The standard does not define bit rates for transmission, except that it says it is intended for bit rates lower than 20,000 bits per second.

6.4 MPLAB IDE

MPLAB is a free integrated development environment for the development of embedded applications on PIC and DSPIC microcontrollers, and is developed by Microchip Technology. MPLAB X is the latest edition of MPLAB, and is developed on the Net Beans platform. MPLAB and MPLAB X support project management, code editing, debugging and programming of Microchip 8-bit, 16-bit and 32-bit PIC microcontrollers.

MPLAB is designed to work with MPLAB-certified devices such as the MPLAB ICD 3 and MPLAB REAL ICE, for programming and debugging PIC microcontrollers using a personal computer.

6.5 PROTEUS SOFTWARE

Proteus (**PRO**cessor for **Te**xt **E**asy to **US**e) is a fully functional, procedural programming language created in 1998 by SIMone Zanella. Proteus incorporates many functions derived from several other languages: C, BASIC, Assembly, Clipper/dBase; it is especially versatile in dealing with strings, having hundreds of dedicated functions. This makes it one of the richest languages for text manipulation. Transforming data from one form to another is the main usage of this language.

CHAPTER 7
POWER SUPPLY

7.1 BLOCK DIAGRAM

The ac voltage, typically 220V rms is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.fig15 shows the various components in block.

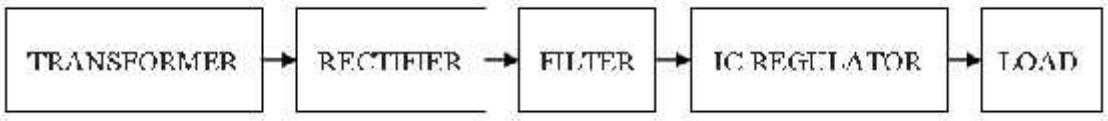


Fig 15-Block diagram of power supply

The potential transformer will step down the power supply voltage (0-230V) to (0-9V). If the secondary has less turns in the coil than the primary, the secondary coil's voltage will decrease and the current or AMPS will increase or decreased depend upon the wire gauge. **This is called a STEPDOWN transformer.**

7.2 BRIDGE RECTIFIER

When four diodes are connected as shown in figure 6, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners. Its circuit diagram is shown in fig 16.

The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.

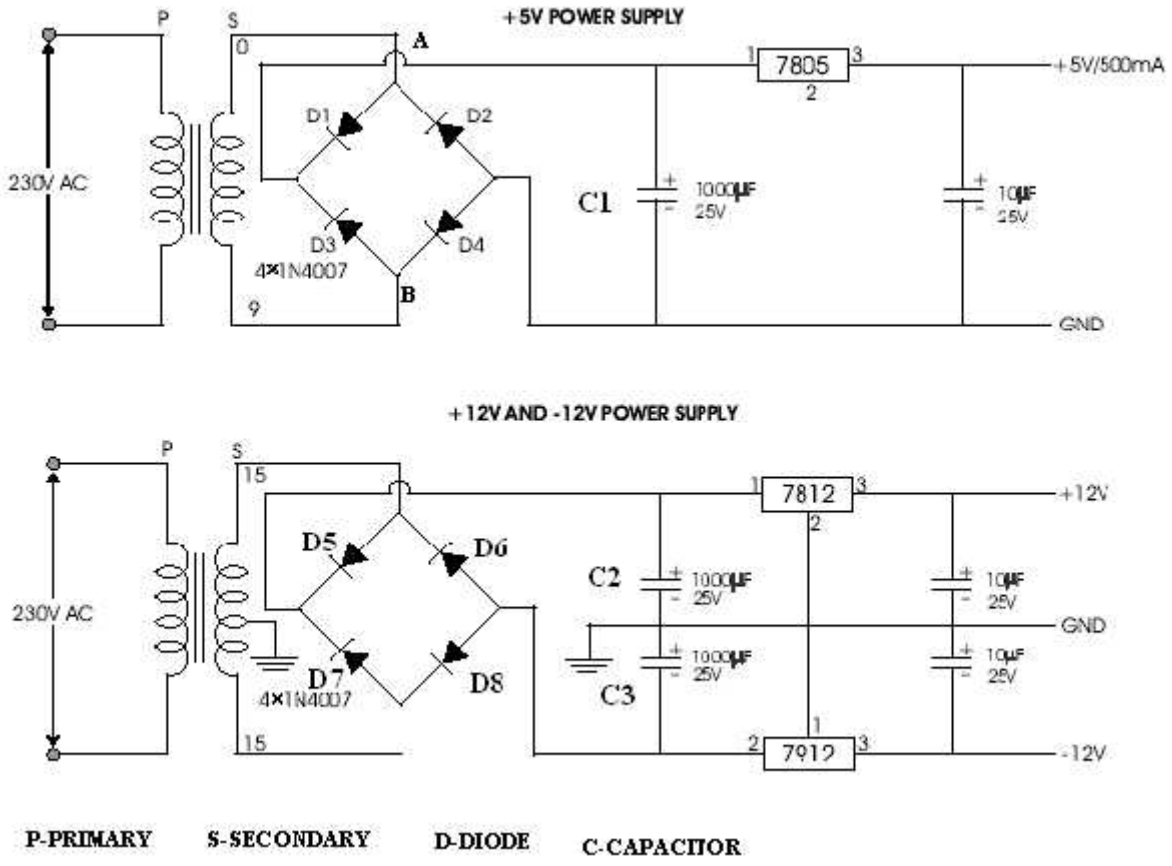


Fig 16-Circuit diagram of Bridge rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional half-wave circuit.

7.3 FILTER

If a Capacitor is added in parallel with the load resistor of a Rectifier to form a Simple Filter Circuit, the output of the Rectifier will be transformed into a more

stable DC Voltage. At first, the capacitor is charged to the peak value of the rectified Waveform. Beyond the peak, the capacitor is discharged through the load resistor until the time at which the rectified voltage exceeds the capacitor voltage. Then the capacitor is charged again and the process repeats itself. Voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a Simple "feed-forward" design or may include negative feedback control loops. It may use an electromechanical mechanism or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

7.4 TRANSFORMER

A transformer is an electrical device that transfers energy between two or more circuits through electromagnetic induction. A varying current in the transformer's primary winding creates a varying magnetic flux in the core and a varying magnetic field impinging on the secondary winding. This varying magnetic field at the secondary induces a varying electromotive force (EMF) or voltage in the secondary winding. Making use of Faraday's Law in conjunction with high magnetic permeability core properties, transformers can thus be designed to efficiently change AC voltages from one voltage level to another within power network.

CHAPTER 8

CONCLUSION

WE CARE an intelligent mobile telecardiology system using GSM interfaced with microcontroller is implemented. The parameters such as temperature, humidity, pressure and heart beat are measured through its corresponding sensors and are applied to port A of PIC 16F877A micro controller which converts the measured analog values into digital values. The informations acquired through corresponding sensors are checked for abnormality. If those values exceeds the normal range then the abnormality is detected and the abnormal values are sent by SMS to the corresponding clinic and relatives of the patient. Even when the abnormality is not detected, the normal values that are monitored periodically are sent. If there is any requirement to know the ECG waveform of the patient, the pulse rate can be converted to ECG signal with the help of visual basic software and the obtained ECG signal is displayed as PQRST waveform. By using this PQRST waveform any abnormality condition in ECG signal is accurately measured. Thus WE CARE is a wearable efficient telecardiology system, that can provide 24/7 health monitoring service with the help of wearable and mobile 3-lead wireless ECG sensor.

CHAPTER 9
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