FINAL YEAR PROJECT REPORT

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In the name of Allah, the Beneficent, the Merciful

DEDICATION

We dedicate our project to our parents, teachers and friends and specially our supervisor Ms.Munazza Younus who was always there to help and guide us and gave us the strength that we can do the finest in our life and told us the difference between the good and bad.

DECLARATION

This project is our individual work. The work we have done is our own effort while we also took help from our teachers and seniors where ever it was needed. The information taken from the sources are mentioned and all the references are given at the end.

- Zaheem Naseer Abbasi

- Rizwan Ishtiaq Raja

April 2012

ABSTRACT

Our aim is to save time for the doctors, while transferring patient to the hospital doctors have to check all the basic parameters to diagnose the condition which takes a lot of time resulting death in most of the cases. Our project is a working model which incorporates sensors to measure parameters like ECG, heart beat rate /pulse rate and body temperature of the patient in the ambulance and transfer it to the computer in the hospital using wireless modules so that the patient's condition can be analyzed by doctors before reaching the hospital and the concerned doctor gets prepared for the treatment. Thus, it reduces the doctor's workload and also saves time when the patient is shifted to the hospital. In the mean while all the process parameters are recorded online and updated till the patient reaches hospital.

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CHAPTER - 1

INTRODUCTION

- Sensors to measure parameters like Body Temperature, Heart Beat rate/Blood pressure and ECG of the patient in the ambulance.
- Transfer data to the hospital so that the patient's health condition can be analyzed by doctors in any part of the hospital.
- A data base will be made in the hospital which will keep the record of the patients parameters and bio-data.
- The data from the ambulance is sent through wireless.

1 OBJECTIVE

We will install the following parameters in the ambulance i.e. Temperature Sensor, Blood Pressure/Heart Beat and ECG. When the patient is shifted in the ambulance these parameters will be measured and sent to the hospital through wireless which will be shown on the PC in the hospital. A database will be made and the readings of the patient are recorded to keep the doctor updated about the condition of the patient and as the patient reaches the hospital the doctor will be ready for the treatment.

1.1 Motivation

In our daily life when a patient is transferred in emergency to the hospital it takes a lot of time for gathering his basic parameters like (body temperature, heartbeat/blood pressure, ECG) due to which it costs death of patient in some cases, as it takes time the condition takes more and more critical and when the patient reaches the hospital the doctor does not know about the basic condition so that he can quickly respond to the patient and do appropriate treatment.

1.2 Problem Statement

Ambulatory Medical Services Over The Wireless Network will enable doctors and patients to access medical information and doctors the ability to treat patients remotely, empowering patients and doctors with information that enables better care and control.

1.3 Problem Solution

Our idea is to build an efficient ambulatory system which can measure the basic parameters of the patient in the ambulance and transmit it to the hospital so that the basic condition of the patient is already known in the hospital and doctors are ready for the treatment. This will save time for the doctors to measure the parameters in hospital thus it might save patient's life.

1.4 Methodology

The methodology adopted for this project is to use sensors to measure ECG, heart beat and body temperature. The sensors used are easy to use by the patient. Signal conditioning circuits are designed to filter and amplify the signals to provide desired output. All the components used in these circuits are low powered. The acquired data is real time and is sent to through the analog-to-digital converter (ADC) and into the PIC microcontroller.

1.4.1 Heart Beat Sensor

Heart Beat Sensor is use to study the heart beat rate. The flow of blood is monitored with the help of heart beat sensor, a clip that is used on the index fingertip in which an LDR is present which calculates the number of pulses per second. Heart Beat Rate differs from person to person as it has a great impact on age. The heart beat rate of a normal person is considered to be 72 per minute. It varies in people of different age groups and areas of life. LED + LDR approach is used to measure the heart beat rate in our project.

1.4.2 Body Temperature

Human body temperature varies within a narrow range of values. Body temperature can be measured from different parts of the body. Temperature depends on many things, including level of activity, time of day, and psychological factors. It also depends on whether the person is eating.

1.4.3 Electrocardiogram (ECG)

ECG was first made by William Einthoven using a crude galvanometer. ECG is taken from the activity of heart muscle when heart pumps itself an electrical signal is taken from the electrodes, as the value of this signal is so very low, this signal is further amplified with the help of operational amplifiers. In our project three electrodes are used to take the ECG 2 are planted on

the chest and 3rd is planted on the chest or wrist of the patient. As ECG is an electrical signal make sure the patient body is not on ground. This amplified value is sent to ADC pin of the micro-controller which converts the analog value to digital value and then it is sent from the transmitter which is then received on the receiver end placed in hospital.

1.5 Advantages

Ambulatory medical services over the wireless network can help us in following key areas.

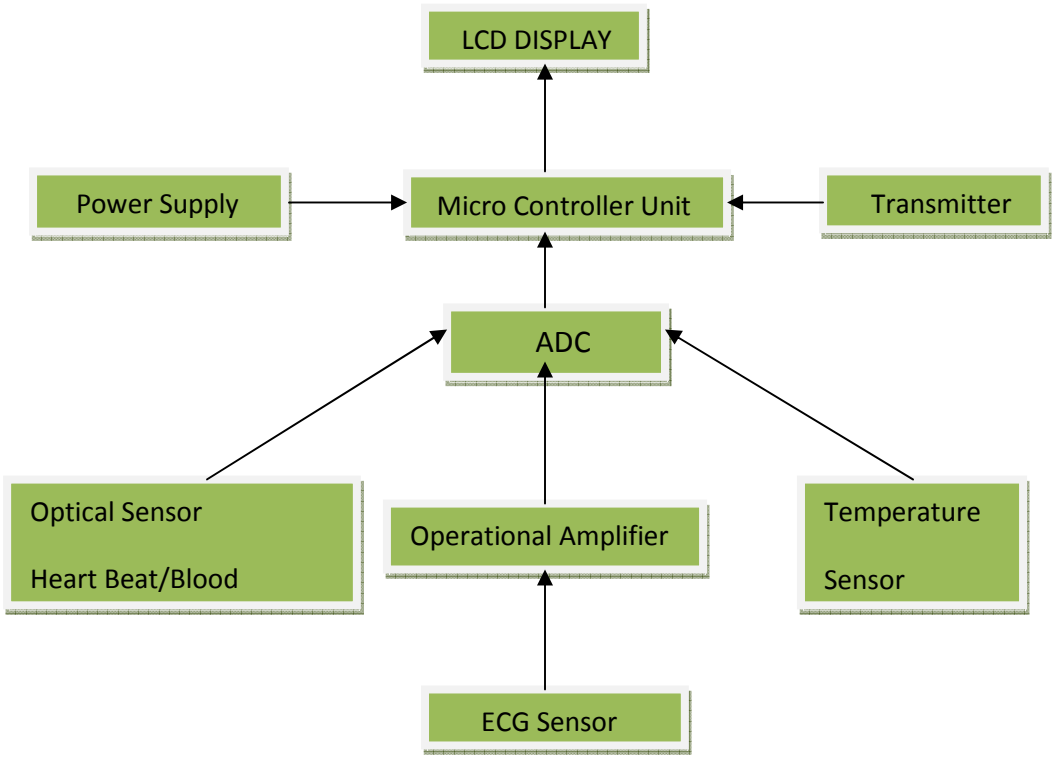
- It will save time for both doctors and patients.
- It will minimize the chance of patient's death.
- Basic parameters are already checked and sent to the doctor so its easier for him to give appropriate treatment.
- With online recoding of medical parameters, the workload of the case providers and the nursing staff is reduced.

CHAPTER - 2

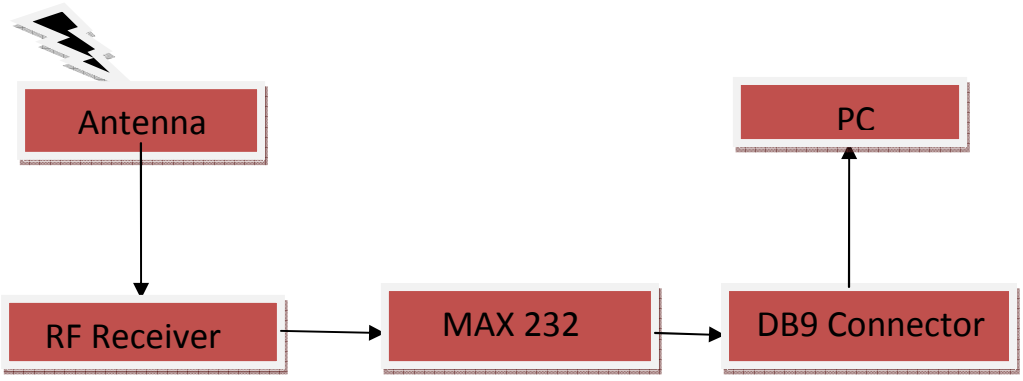
2 PROJECT APPROACH

2.1 BLOCK DIARGRAM

2.1.1 (SENDER SIDE)



2.1.2 Receiver Side



2.2 Explanation

The block diagram explains how the system works. In a moving ambulance while transferring patient the microcontroller is connected to a power supply and it will send data to the transceiver for wireless transmission. Data transferred wirelessly will be received by a receiver and will be displayed on computer screen which is connected to other computers via LAN. The microcontroller will also send data to the LCD. The LCD will display the information on its screen which can be seen in the ambulance while the recorded data can be seen on computer in the hospital.

CHAPTER - 3

3 REVIEW OF LITERATURE

3.1 Micro-Controller

Figure 3.1.1

3.2 PIC 16F877

Microcontroller consist of total 40 pin first 1 to 8 pin are connected with ULN 2803 which is used to step up a low power to high power and there is another ULN 2803 with the controller pins no 12 to 15 and next pins no 16 and 17 are connected to the max 232 and pins no 18,19,20 is ground pin no 21 is connected with an LED and next pins no 22 to 28 are connected with the LCD pins and pins no 32 to 39 is connected with the LM 7805and pin no 40 have VCC.

3.3 MAX 232

3.3.1 General Description

MAX 232 is work at -15v to -3v on high and +3 to +15 at low node which is not normal for the logic of computers to understand it properly as computer work at 0v to +5v and now the new upcoming logic work at v to 3.3v or may lower then this.

Figure 3.3.1

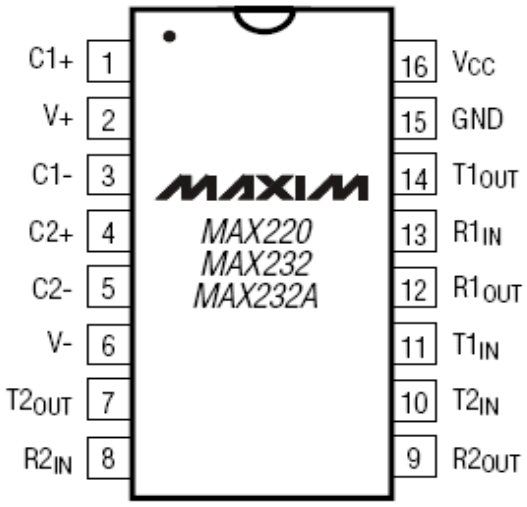
3.3.2 Packaging

Max 232 level of signal is too high to tackle by the computer logic and at negative voltage it is also high for it to understand by the computer logic as the information coming from serial port is to high so it has to be reduced so when a low voltage is coming it has to step up and a high voltage coming up is to step down to communicate with it or to avoid to short circuit of the circuit

Max 232 was first IC to be invented in which we have both function of sending and receiving and this IC became known IC because it can operate at 5v to give max 232 voltage levels and no voltage supply is required to tackle the max 232 IC and to give it just 5v supply to works.

3.3.3 Function

Max 232 has the system inside which step up the charge of +5v to +10 v to work with the circuitry. Working of the pin is that the c1 capacitor step up the 5v to +10 v and on other hand we have v+ at c3 and other capacitor c2 is used to convert +10 v to -10 v and with this c4 give v- output. In max 232 there is drawback that it draw voltage when we go from +10v to -10 v output on the other hand max 225 and max 245 and max 247 do not do so because they don't have the v+ and v- so as the voltage drops it increases the load current and in our project it is used to convert the voltage to 5v to 10 to communicate with the serial port or DB9 connector and with the modem .



CAPACITANCE (μF)					
DEVICE	C1	C2	C3	C4	C5
MAX220	4.7	4.7	10	10	4.7
MAX232	1.0	1.0	1.0	1.0	1.0
MAX232A	0.1	0.1	0.1	0.1	0.1

Figure 3.3.3.1

3.4 Sensor

3.4.1 Temperature Sensor:

The purpose of temperature sensor is to sense the temperature of the body. In this sensor the temperature varies with resistance giving different values of voltage hence the temperature is recorded in mille -Volts.

3.4.2 Thermistor

It is a thermal resistor, which changes its value with temperature. Change in temperature can vary the value of the resistor. Basically thermistors are of 2 types

- Negative temperature coefficient
- Positive temperature coefficient

NTC are used to measure temperature and PTC are used as fuses.

Thermistors have some benefits over other kinds of temperature sensors such as analog output chips (LM35/TMP36) or digital temperature sensor chips (DS18B20) or thermocouples .

- First off, they are much cheaper than all the above
- They are also much easier to waterproof since its just a resistor.
- They work at any voltage (digital sensors require 3 or 5V logic).
- Compared to a thermocouple, they don't require an amplifier to read the minute voltages - you can use any microcontroller to read a thermistor.
- They are difficult to break or damage - they are much simpler and more reliable

On the other hand, they require a little more work to interpret readings, and they don't work at very high temperatures like thermocouples. Without a digital-to-analog converter on board, you might be better off with a digital temperature sensor.

To measure the temperature, we need to measure the resistance. However, a microcontroller does not have a resistance-meter built in. Instead, it only has a voltage reader known as a analog-digital-converter. So what we have to do is convert the resistance into a voltage, and we'll do that by adding another resistor and connecting them in series. Now you just measure the voltage in the middle, as the resistance changes, the voltage changes too, according to the simple voltage-divider equation. We just need to keep one resistor fixed

- Thermistor temperature range -55°C to 125°C

3.5 DB9 Male Connector

It is a parallel based data interference which is used to make mouse based connection. Its pin num 1 is output pin on which data transmission gets high, which shows that the data transmission takes place.

Pin 1 is output that is parallel with LED on the board and it goes high when FIEHN EME program indicates that it is transmit period.

Pin 7 and pin 8 are used to connect the device with the hardware. In our project db9 connector is used for serial communication of data. Which means the data taken from hardware can be seen on PC.

Male DB9 - Auxiliary Connector	
1	Transmitter LED output (for sequencing)
2	Transmitter d out (for mouse)
3	Receiver d in (for mouse)
4	Processor reset
5	Ground
6	Parallel Load out
7	Parallel Clock out and Processor RB6 (for programming).
8	Parallel Data in, Mouse , and Processor RB3 (for debugging).
9	VCC out (+5 Vdc)

3.6 Crystal Oscillator

It is used to get the output on regular basis and the wave form received is an electrical or sine wave. It generates clock and frequency is the most important thing that crystal Oscillator repeats.

1 MHz = 10, 00000 repetition/sec

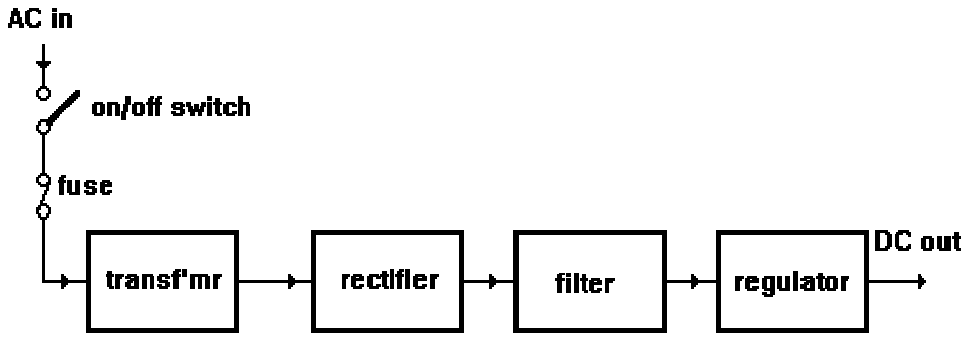
Quartz Crystal is used for the maintenance of crystal oscillator as some time due to repetition of data abrupt change occurs in data to overcome this change quartz crystal is used which minimizes the error rate.

Figure 3.6.1

3.7 DC Power Supply

A DC power supply is needed to control the voltage levels as the components used contains different voltage levels i.e. PIC Micro-controller works on 5 volts and more than 5 volts of voltage can cause damage same as a personal computer works on 12 to 15 volts.

To maintain voltage level Dc supply is used and for low level voltages regulator is used, it contains a Bridge Rectifier which converts AC to DC. The voltage taken from our home sockets is 220V this 220V after passing from the transformer and then from the bridge rectifier is changed into 5V or the voltages of the element needed. Filters are used to remove the noise or to amplify the signals.



A transformer is used to step down the high voltage of AC then this step down value is passed through the rectifier which contains diodes which converts AC voltage to DC voltage as the taken DC voltage is not smooth and to make it smooth it is passed through filters which may be capacitor as well as resistors through which the minimum variation in value can be removed to get a smooth value as, the value taken from the transformer is not in a regular manner, filters are used to smooth the maximum value or else regulators can also be used to get a low value.

3.8 Light Emitting Diode (LED)

Light emitting diode is used to get the value from the micro-controller as on every value either high or low micro-controller gives a interrupt on the program. The light of LED shows either the value of micro-controller is high or low. Led is connected to the output.

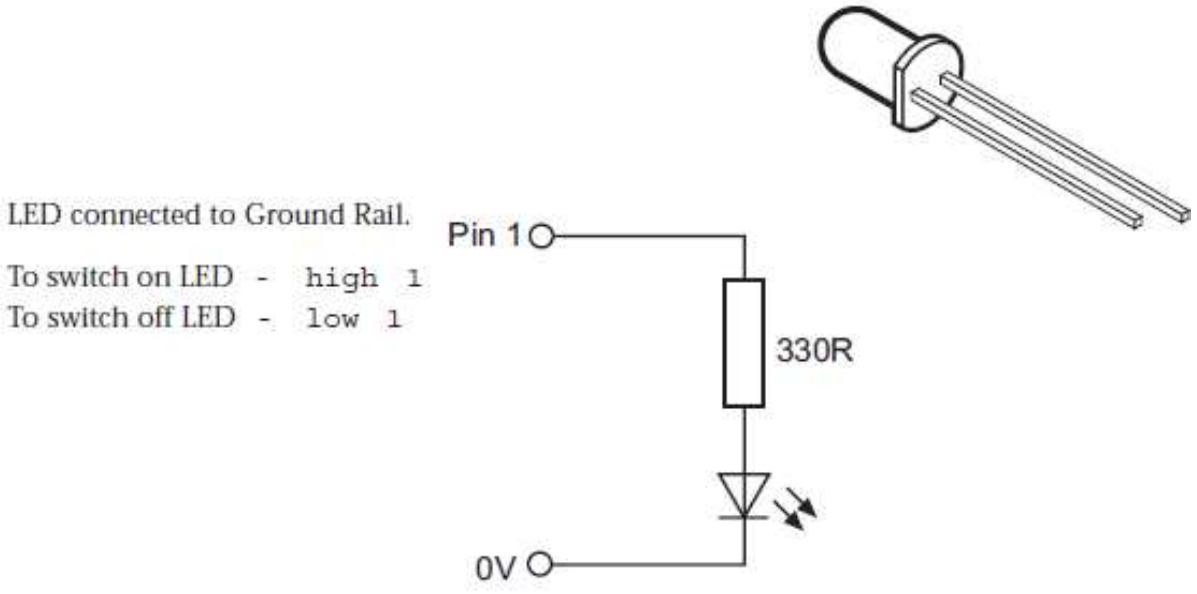
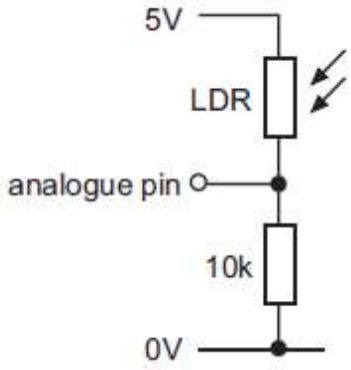


Figure 3.8.1

3.8.1 Light Sensor (Photocells)



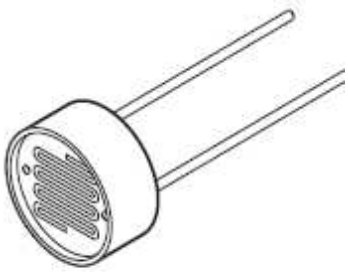


Figure 3.8.1.1

It changes its value according to the intensity of light falling in it. Its resistance depends upon light. When light falls on a photo cell it give clock to the micro controller either high or low. Each clock gives a value to microcontroller which start counting the number clocks on each variations. Microcontroller is programmed so that it increments value on each variation and this value is used to calculate the number of pulse of a patient. As it does not gives the accurate value but the value taken from this is very close to real one. Microcontroller is programmed to generate an interrupt after every 60 sec, so the number of pulses calculate in the mean time are over related output.

3.9 Proton IDE PIC Compiler

Proton IDE is used to program the PIC 16F877A micro-controller.

It is a expert and commanding visual Integrated Development Environment (IDE) designed particularly for the Proton compiler. It is not complex as compared to other compilers.

It is uncomplicated and easy to use.

- Code generation is easy as compared to other compilers.
- Code can be tested by with virtual simulator.
- Proton update is free of cost.
- It is similar in temperament with Windows.
- It also have a code explorer.

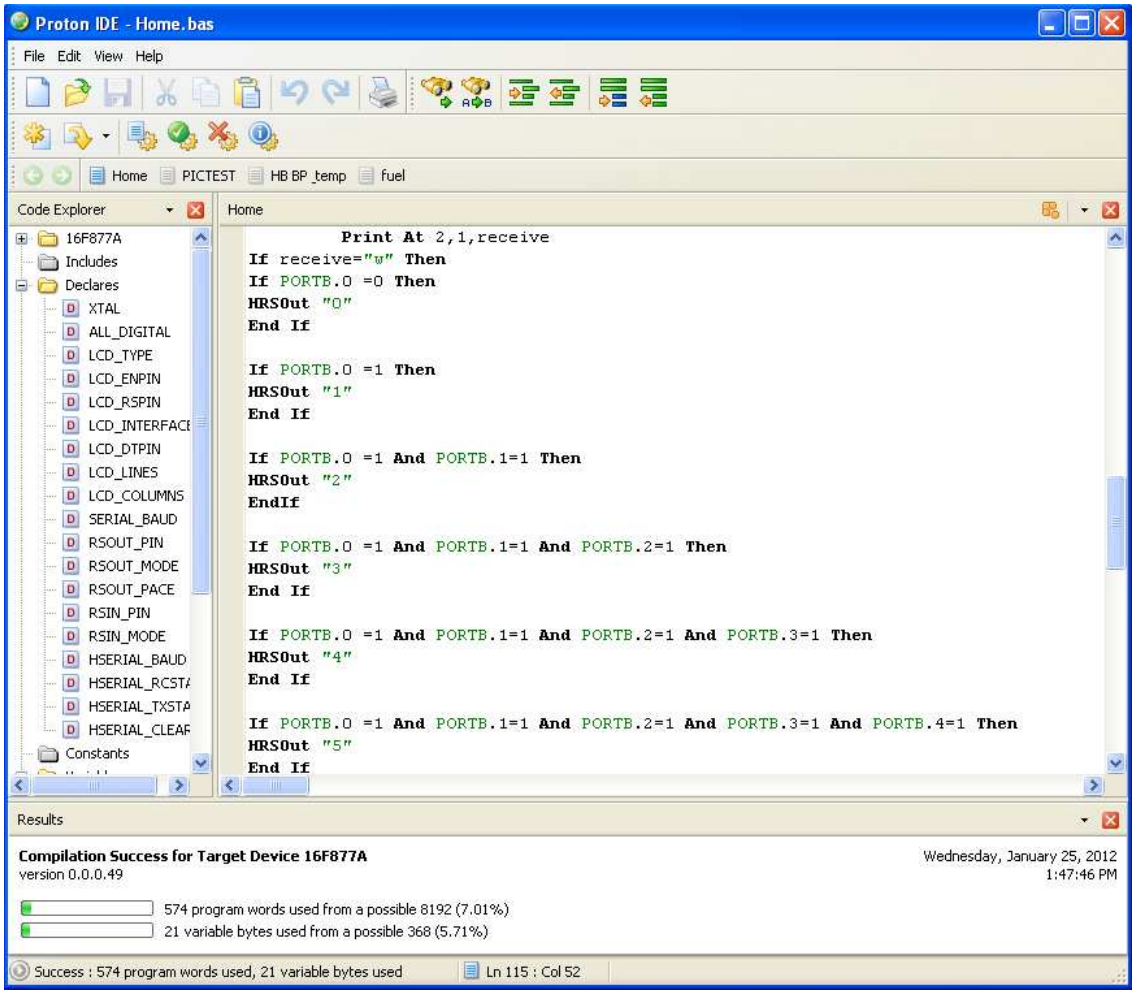


Figure 3.9.1

- It supports byte, bit and word variables.
- Number of arrays is up to 256 element.
- Data table hold up is admirable
- Graphics LCD support is better.

Proton (IDE) is deliberate to speed up product development in a easy user development environment without compromising the performance and suppleness.

3.9.1 Operating Systems Supported by Proton IDE

It supports the following systems

Ms[Windows 98], Windows 98 special edition, windows ME, windows (NT 4.0), windows 2000 and windows XP

3.9.2 Hardware Required by Proton IDE

Processor at least (500 MHz or higher)

Ram (128 MB or higher)

Hard drive 40 MB

Graphics card 16 Bit

3.10 RS-232C

Recommend Standard number - 232 and C is the latest revision of this standard. The serial ports on most computers use a compartment of the RS-232 C standard. Rs 232 C consist of a 25 pin out of which only 22 pins are used because all pins are not required for the communication of Personal Computers. The latest PCs now a days have a type D male connector installed containing only 9 pins.

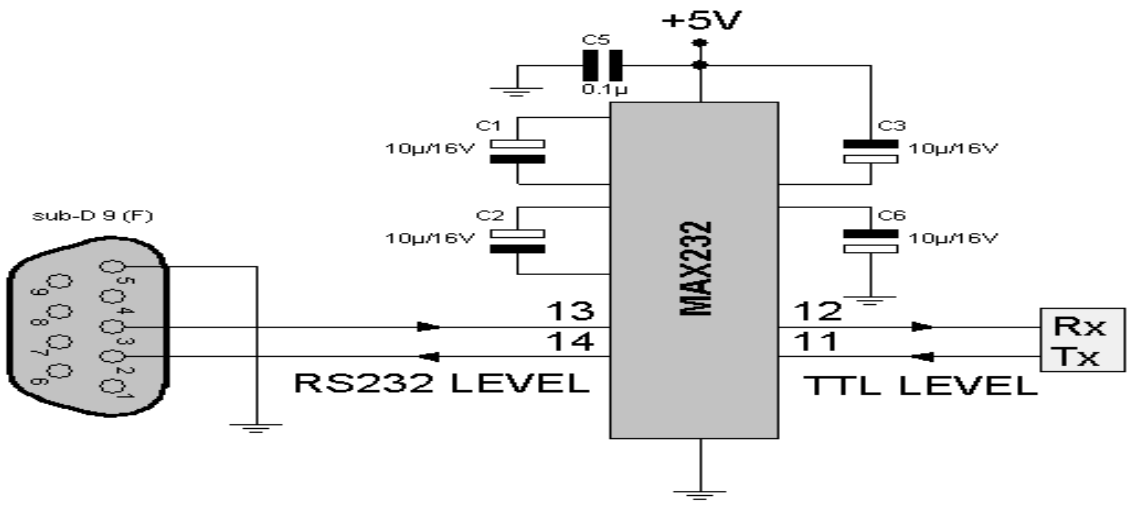


Figure 3.10.1

3.11 Serial and Parallel Communication

Several PCs and companionable computers are outfitted with two serial ports and one parallel port. Both of these ports have the same work to do that is communicating with the others but still they are different in their working.

8 separate wires are used for sending and receiving data in parallel type of communication at the same time. By doing so the data can be sent very fast but for this the cable used is large because it contains the wires. Normally a parallel port is used to connect a PC to a printer. On the other hand data is transferred only on one wire in serial communication but it's a time taking procedure as compared to the parallel type. Three wires are used for full duplex communication 1 wire is used for sending, 1 for receiving and 1 is ground wire.

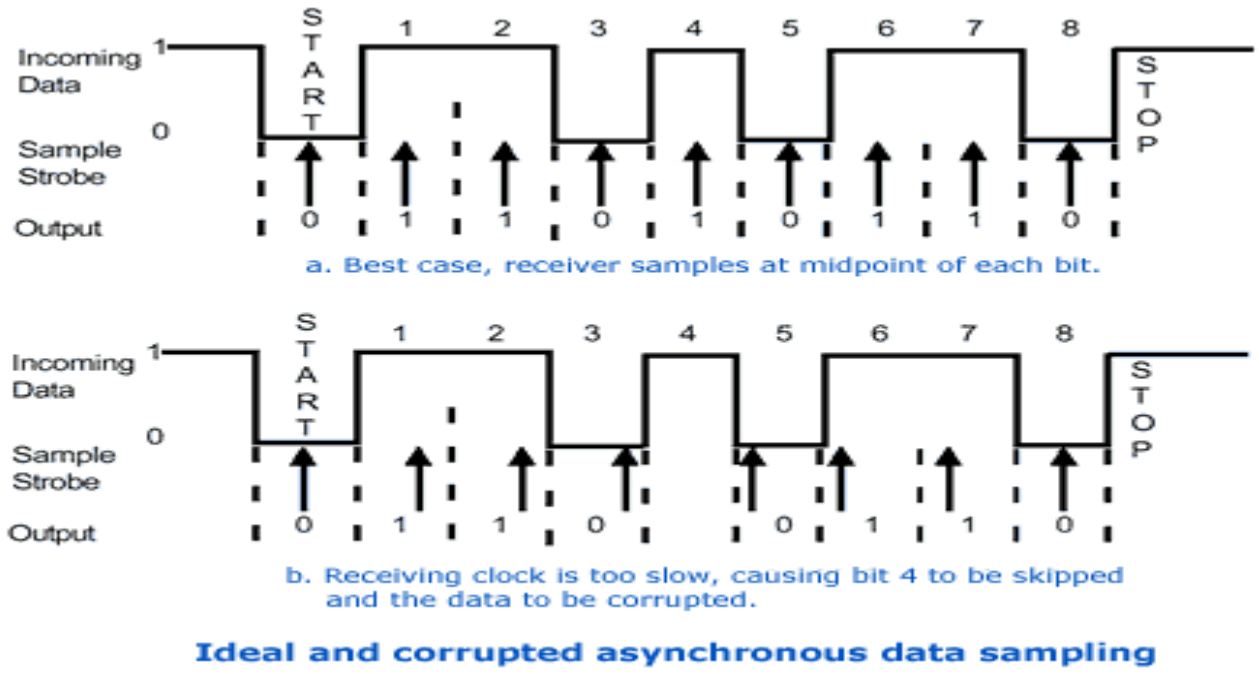


Figure 3.11.1

3.12 Visual basic 6.0

Visual Basic 6 is a high level programming language and have a integrated development environment (IDE) from Microsoft.

Visual Basic (VB) is an ideal programming language for developing complicated professional applications for MS Windows. It makes use of Graphical User Interface for developing strong and powerful applications. The Graphical User Interface as the name shows, uses illustrations for text, which enable users to work together with an application.

GUI is the coding of program or data to be executed in Visual Basic, VB itself is a user friendly tool to work with, which allows the data to be expressed on user interface. It is easier to access both small and long operations performed in GUI. VB itself is a programming language which is used in microprocessor based computers. In the beginning it was just basic programming performed in it. But now extended versions of VB's are used which contains more advance programming. Microsoft created advance versions of visual basic which are called as Visual Basic for windows.

3.12.1 Visual Basic 6.0 IDE

Visual Basic IDE is contains many components

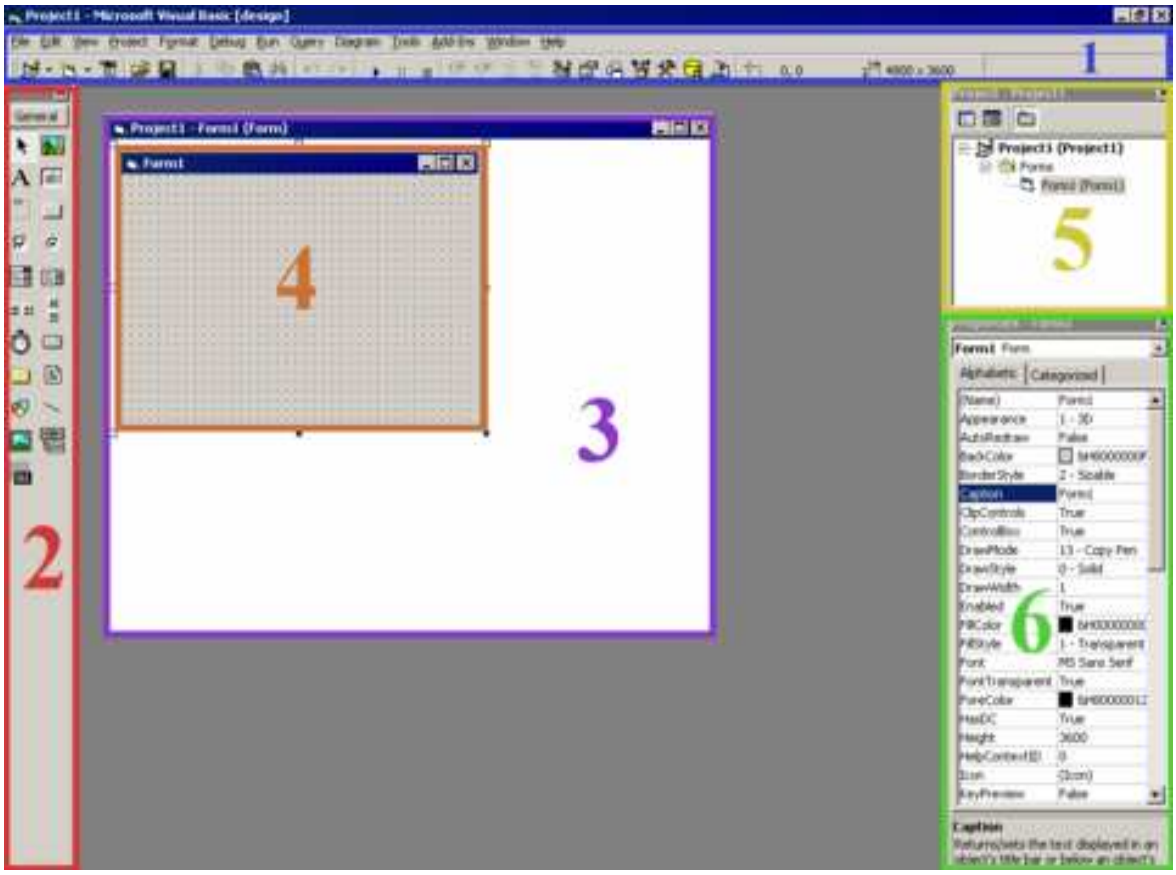


Figure 3.12.1.1

1. Menu and Tool bars: There are different options for manage the IDE and editing programs.

2. Toolbox: It contains different objects like textbox, buttons, labels, etc.

3. Object Window: It contains Form or User Control.

4. Graphical object: This show how your application will look like. In figure there is a form named Form1

5. Project Explorer: This is the place from where you explore different file in the project.

6. Properties window: Here, you select the different properties of objects and change the properties .

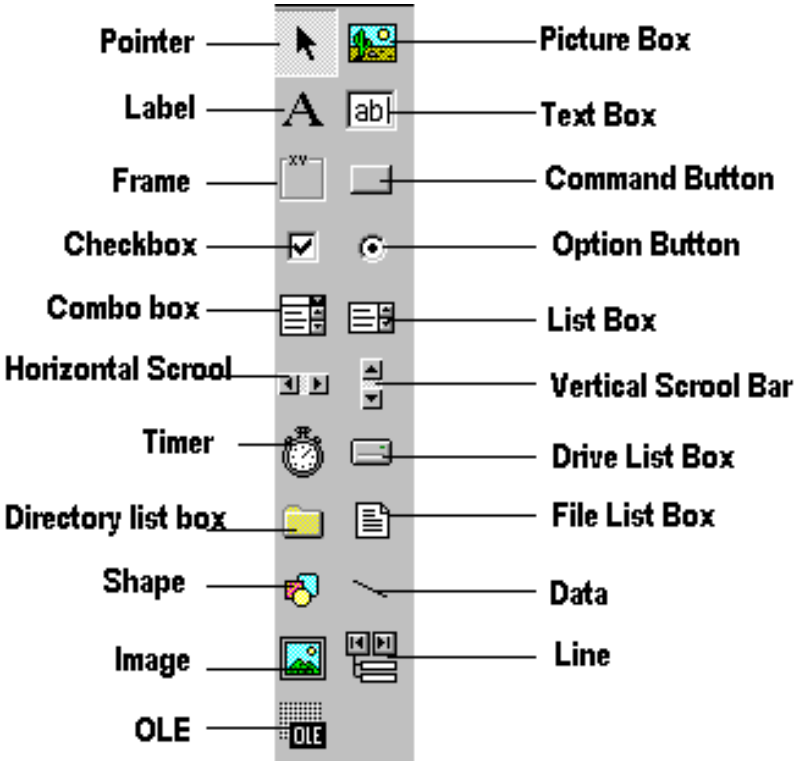


Figure 3.12.1.2

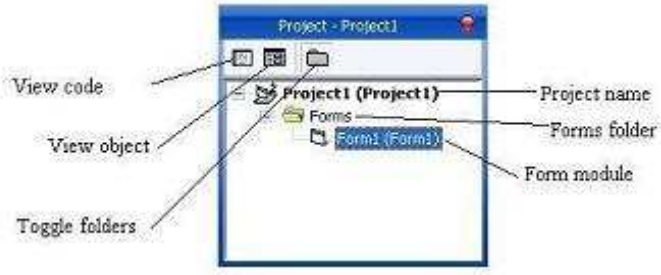


Figure 3.12.1.3

3.13 BM100B micro power wireless module

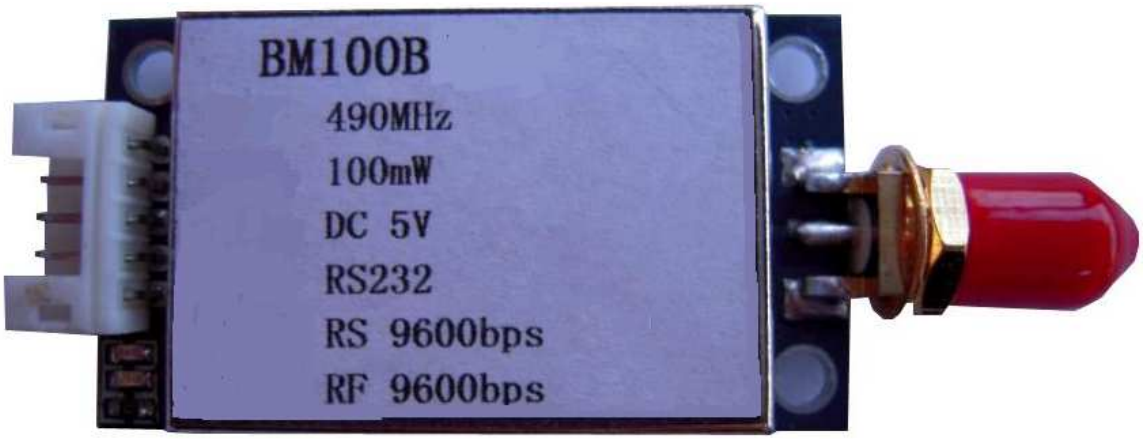


Figure 3.13.1

3.13.1 Introduction BM100B module

BM100B wireless data transmission module is a small size high-performance GFSK modulation mode transparent wireless data transceivers.

Can work in 315/433/490/868/915MHz the ISM band.

The internal auto-complete communication protocol conversion and data transceiver control. The module provides a UART (TTL), 232 or 485 serial data access.

According to User needs there is flexibility through the PC software to configure the parameters such as module serial rate, operating channels, transmit power, communication data rate

The BM100B modules can be widely applied to various types of wireless data transmission, an ideal choice for the design of wireless data transmission products

3.13.2 BM100B of Module Features

- High performance, high reliability, GFSK modulation, network connectivity, control and operation.
- Operating frequency 433/490/868/915MHz
- Maximum output power of 100mW (20dBm), the output power can be adjusted within the range of 1 ~ 20dBm
- Receiver sensitivity up to-124dBm
- Transmitting operating current of 100mA @ 20dBm 30mA @ 11dBm
- Receiver operating current of 35mA (can be customized to 30mA), sleep current <5uA.
- Standard configuration provides 8 channels to meet the needs of the multiple communication combination mode
- Communication protocol conversion and RF transceiver switching is done automatically, users do not interfere with ,easy to use.
- Communication speed of 1.2kbps to 115.2kbps, the user can be configured through software, compliance with FCC and ETSI standards, the wide temperature range of stability.

3.13.3 Application

- Biomedical Wireless system
- The anti-theft alarm System
- Medical and electronic instrumentation, automation and control
- Intelligent teaching equipment
- Home appliances and lighting intelligent control
- Water, electricity, gas, heating, automatic meter reading system
- Wireless conference vote, the scoring system
- Wireless ordering system

- Reactive power compensation and network monitoring
- Community and public places LED screen wireless solution
- Electronic weighing, wireless crane scale, vehicle monitoring
- Bar code reader to the POS system
- Video surveillance PTZ control
- PLC data long-distance wireless communication
- Hospital ward call system
- Meteorological / wells / irrigation device information acquisition
- Railway locomotive remote detection
- Access Control Reader
- Industrial equipment, wireless data transmission
- Wireless sensor networks

3.13.4 BM100B module pin definition

1 VCC Positive power supply (3.3-5.5V) ≤ 100mV

2 GND For negative

3 TXD Serial data send

4 RXD Serial data receiver

5 SLE Sleep control side (≥ 2V or floating dormant ≤ 0.5V normal work) TTL level

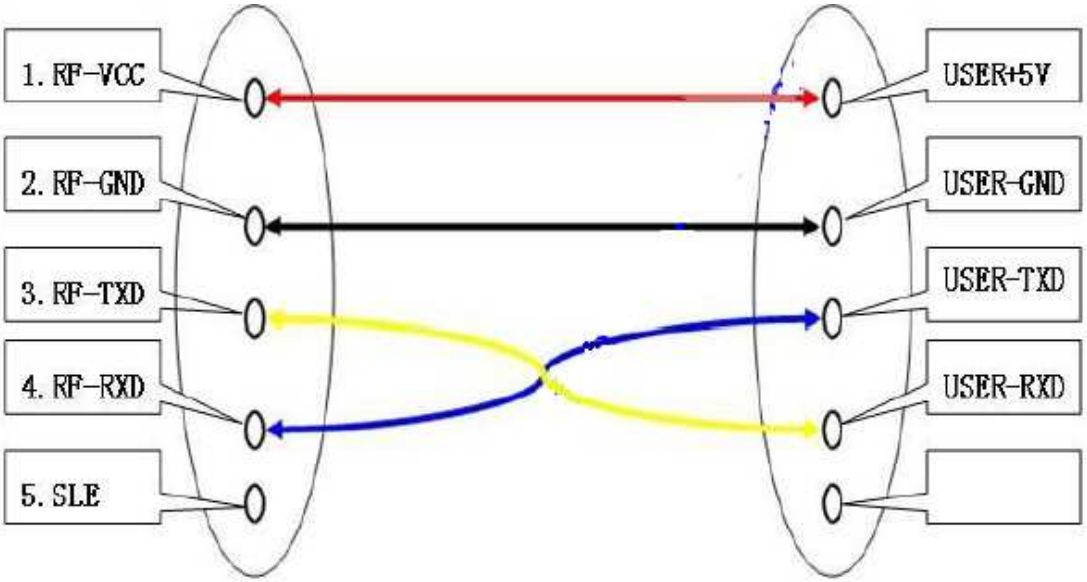
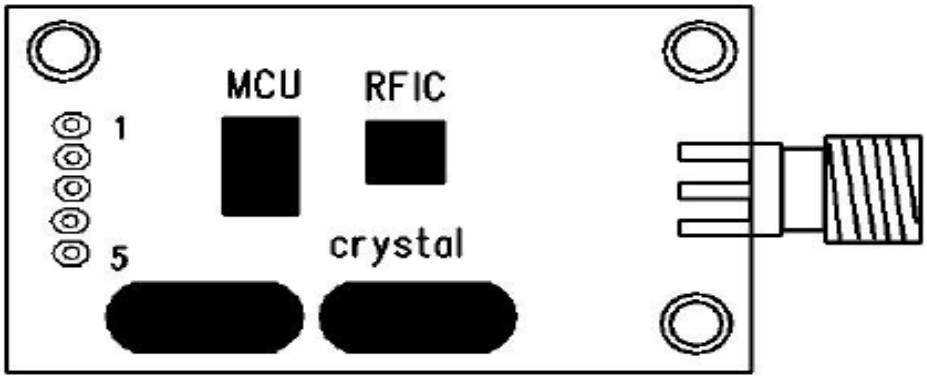


Figure 3.13.4.1

BM100B module and customer equipment cable (RS232, TTL)

User modify the parameters through the PC software of the module there are different parameters such as transceiver channel, modulation rate, the serial port rate, and output power.



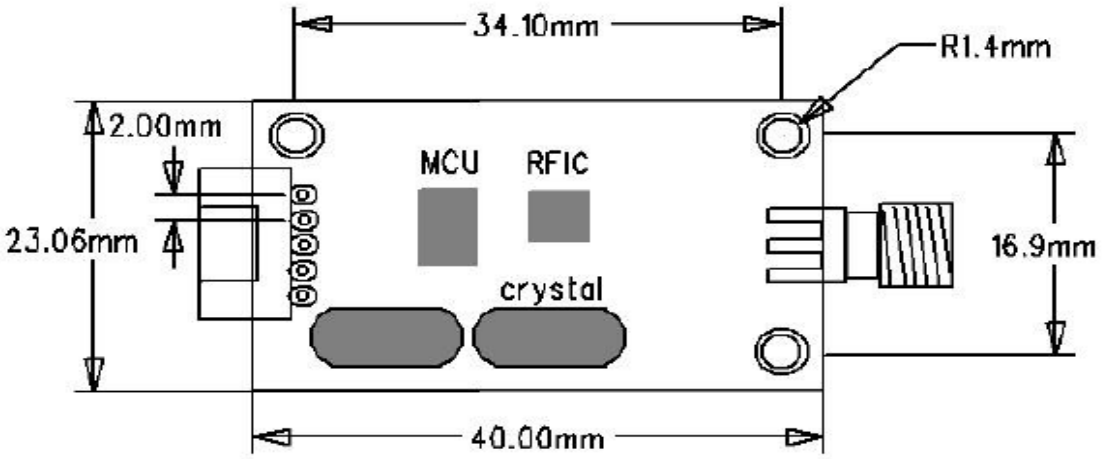


Figure 3.13.4.2

BM100B module Internal Structure Map

3.13.5 Setting Method through Software

- Connect module with Computer
- Turn the power on,
- Open the PC software,
- Click on the module detection
- The software will automatically scan module parameters.

CHAPTER - 4

4 Initial Hardware Design & Details

4.1 Circuit Components and Working

First we started work on the power supply section. The transformer used as a power supply has voltage source providing an input voltage of 220 volts and output of 12 volts. On the power supply circuit we used 4 resistors having resistance of 220 ohm which are connected to a capacitor having 1000 micro farad capacitance. Moreover LED is connected to check the current flow. As shown clearly in the figure.

Figure 4.1.1

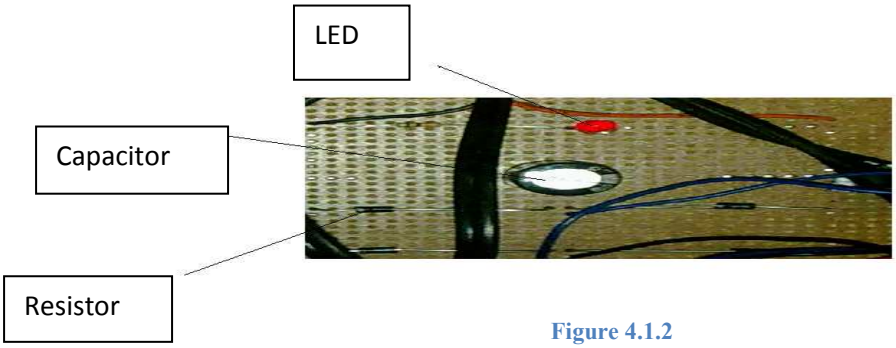


Figure 4.1.2

4.2 Heart Beat Sensor

Heart Beat Sensor is use to study the heart beat rate. The flow of blood is monitored with the help of heart beat sensor, a clip that is used on the index fingertip in which an LDR is present which calculates the number of pulses per second. Heart Beat Rate differs from person to person as it has a great impact on age. The heart beat rate of a normal person is considered to be 72 per

minute. It varies in people of different age groups and areas of life. LED + LDR approach is used to measure the heart beat rate in our project.

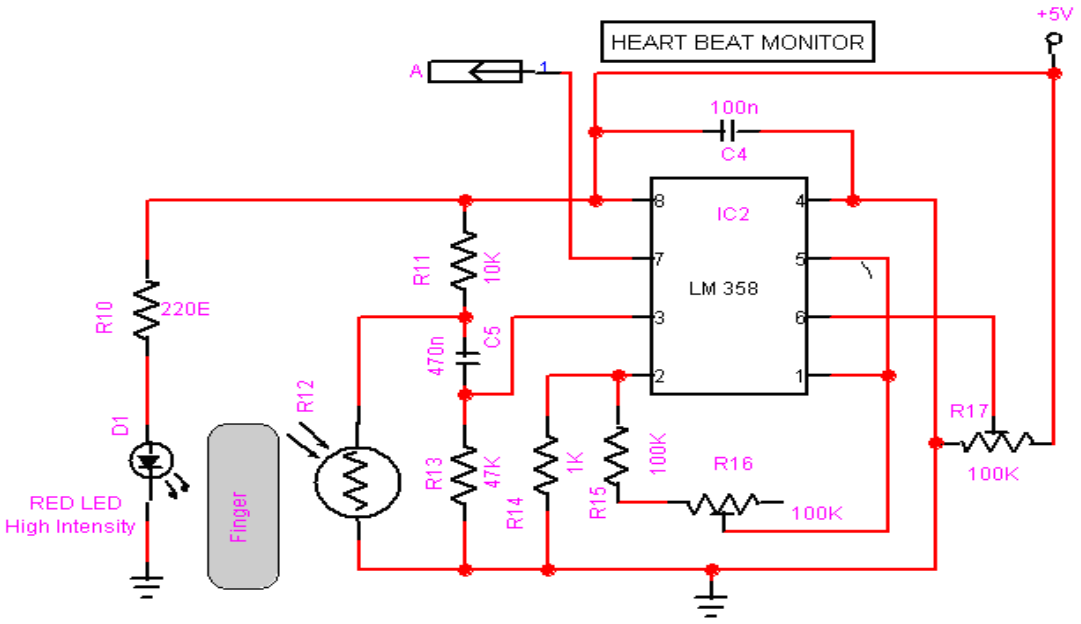


Figure 4.2.1
Hearts Beat Sensors

4.3 Body Temperature

Human body temperature varies within a narrow range of values. Body temperature can be measured from different parts of the body. Temperature depends on many things, including level of activity, time of day, and psychological factors. It also depends on whether the person is eating.

4.4 Electrocardiogram (ECG)

ECG was first made by William Einthoven using a crude galvanometer. ECG is taken from the activity of heart muscle when heart pumps itself an electrical signal is taken from the electrodes, as the value of this signal is so very low, this signal is further amplified with the help of operational amplifiers. In our project three electrodes are used to take the ECG 2 are planted on

the chest and 3rd is planted on the chest or wrist of the patient. As ECG is an electrical signal make sure the patient body is not on ground. This amplified value is sent to ADC pin of the micro-controller which converts the analog value to digital value and then it is sent from the transmitter which is then received on the receiver end placed in hospital.

ECG signal

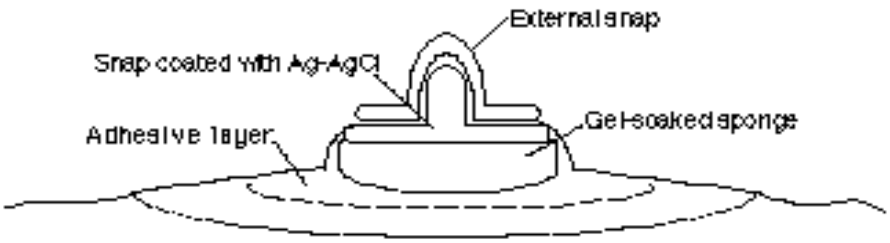
4.4.1 Need for ECG

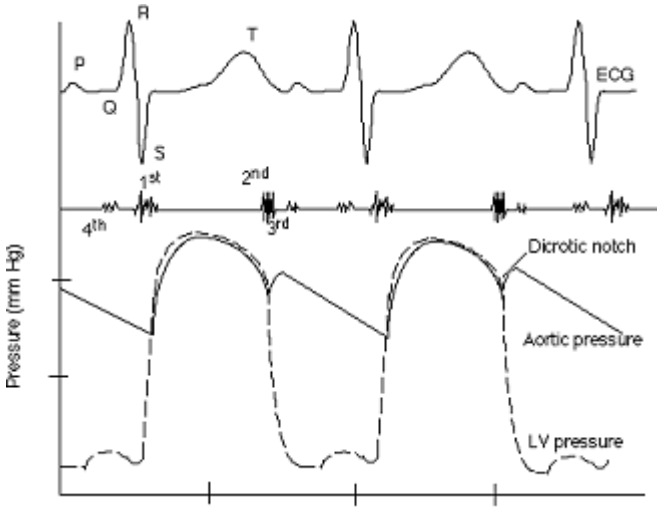
ECG signal is used by the doctors to check the patient heart situation in the following situations

- When a heart attack occurs
- When parts of the heart is damaged
- In case of irregular heart beats

4.4.2 Working

Electrodes are used to convert ECG into voltage. Electrode used for ECG measurement is composed of Ag/Ag Cl, shown in figure below. The electrodes can be easy removed and they can be disposed.





The ECG cardiac cycle

The figure shows the cardiac cycle of the heart.

ECG can be measured by connecting 2 electrodes on the chest or wrist and 1 on thigh, as shown on the figure below. The body should be grounded because if it is not the signal cannot be obtained.

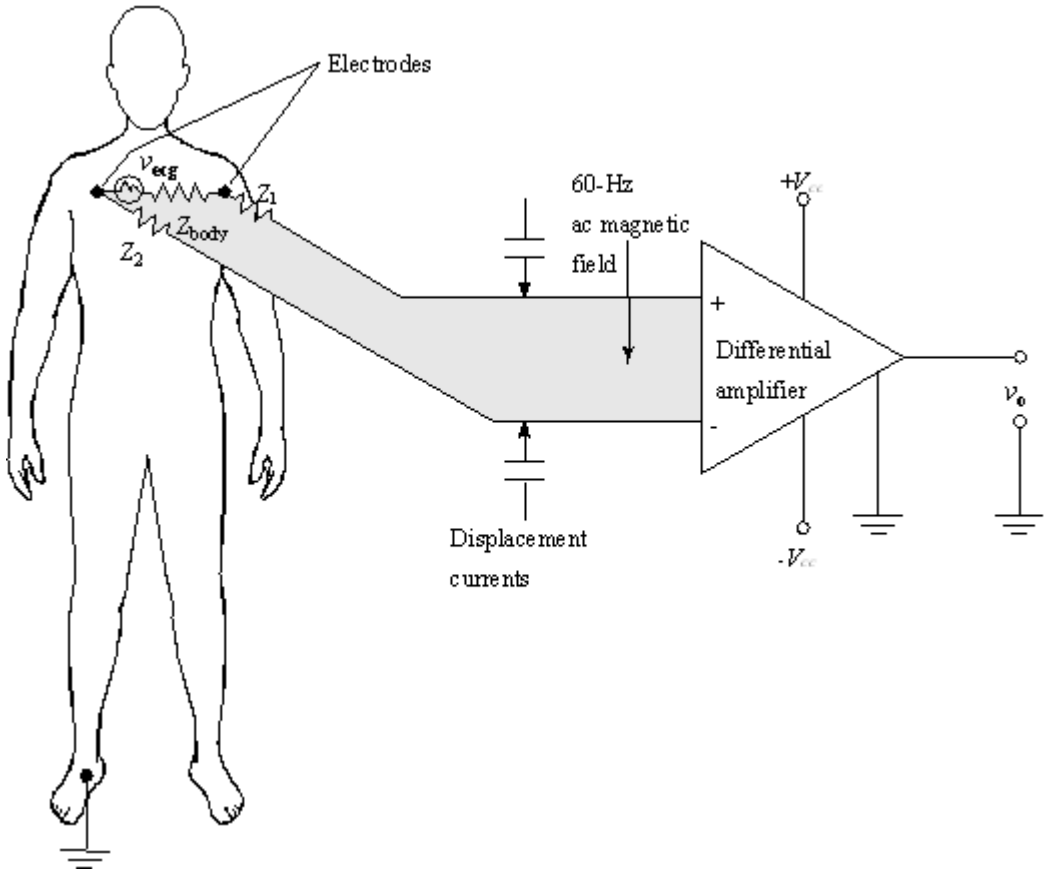


Figure 4.4.2.1
Simplified ECG recording system

Three electrodes are used to measure the ECG . 2 electrodes are used for measuring the ECG while 3rd is used as ground. The value taken from the electrodes is very low so it is further sent to Operational Amplifiers which further sends it to microcontroller.

4.4.3 ECG Circuit Diagram

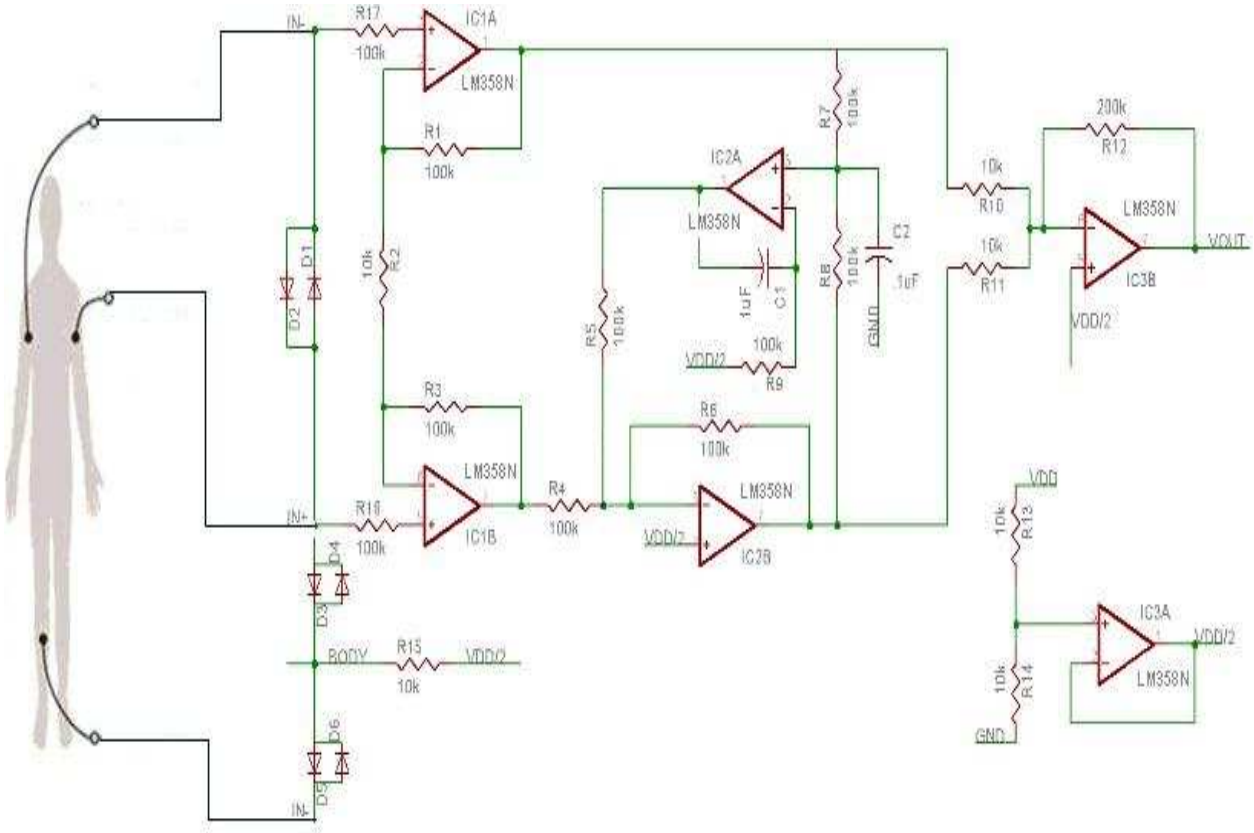


Figure 4.4.3.1

The diagram shows the circuit which we have used and implemented in our project.

4.5 Software Implementation

4.5.1 Graphic User Interface

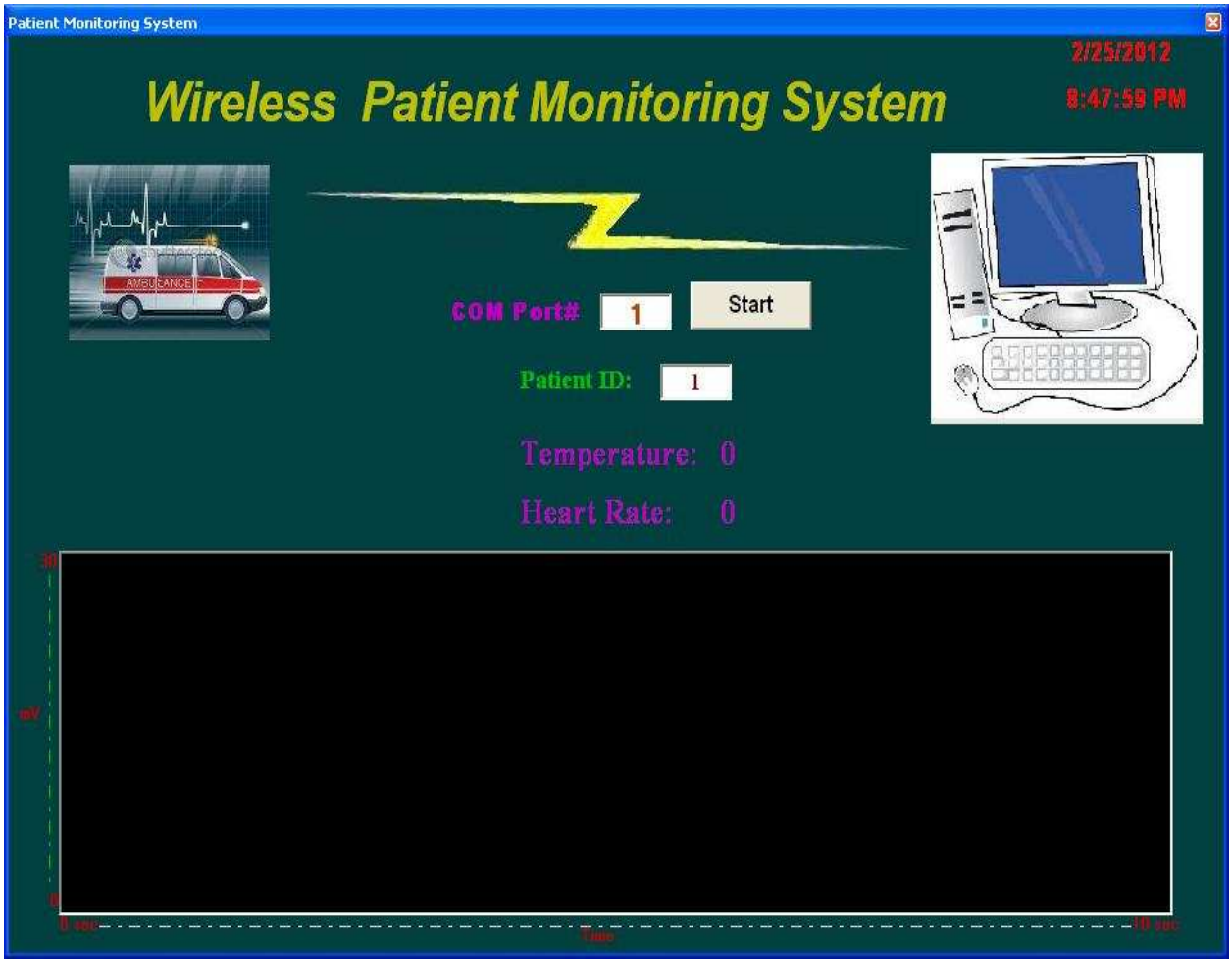


Figure 5.1.1
Graphic User Interface

CHAPTER - 5

5.1 Conclusion

In third world countries like Pakistan where it takes long time to transfer patient from home to hospital due to traffic and etc. Which in mostly cases cause death of the patient .If patient reach hospital in time the time taken in entering data of patient, occupying space and checking basic parameters can also cause patient's death. So to overcome all these problems Ambulatory Medical Services can be useful and can save one's life. As basic parameters and online recorded data is already sent to the hospital, while transferring patient .It can increase doctors efficiency ,and can reduce their workload. With the use of patient monitoring wireless nodes doctors load can be overcome as they are not suppose to go and check again and again the patient's condition.

5.2 Future Work

In future more parameters can be added in our project like Sugar Sensors, Blood pressure Sensors etc which will help in measuring the more accurate condition of the patient. Using RFID ambulance shortest path to the hospital can also be defined .As traffic signals can also be controlled though RFID. Adding these sensing components would make this system a complete vital signs monitor

REFRENCES

[1] http://www.keil.com/c51/

[2] Wireless communication: Principles and Practice , Second Edition by : T.S. Rappaport

[3] http://www.torry.net/authorsmore.php%3Fid%3D2768

[4] http://www.w2drz.ramcoinc.com/maledb9.htm

[5] http://www.kpsec.freeuk.com/powersup.htm

APPENDIX

Microcontroller Code

```
//Compiler PIC Proton IDE
//Language  PIC Basic

Device 16F877A
XTAL 4

Declare LCD_TYPE 0        //in case we use alphanumeric then type 0 if graphical then 1
Declare LCD_ENPIN PORTD.0 //declaring enable pin
Declare LCD_RSPIN PORTD.1 //declaring lcd reset pin
Declare LCD_INTERFACE 4   //this shows the lcd will be 4 bit interface with microcontroller
Declare LCD_DTPIN PORTc.0 //this show that 4 pin interface and this is the start pin
Declare LCD_LINES 2       //telling how much rows lcd has
Declare LCD_COLUMNS 16

SERIAL_BAUD = 9600
RSOUT_PIN = PORTC.6
RSOUT_MODE = TRUE
RSIN_PIN = PORTC.7
RSIN_MODE = TRUE

on_interrupt hb_receive                  //on_hardware_interrupt hardware
```

```
Dim hb_counter As Byte
Dim ADc_RESULT As Word
ADCON1 = %10000000



main:


Cls
Print At 1,1, " WELCOME TO THE"
Print At 2,1"    PROJECT"

DelayMS 2000



While 1=1


Cls
Print At 1,1, "Receiving....."
hb_counter = 0

DelayMS 1500
    ADc_RESULT = ADIn 0                    // TEMPERTAURE
    Print At 2,1, "Temperature: ", Dec ADc_RESULT
    HRSOut "Temperature:", Dec ADc_RESULT
```

```
DelayMS 15000
    ADc_RESULT = ADIn 0
    Print At 2,1, "Temperature ", Dec ADc_RESULT
    HRSOut "Temperature:", Dec ADc_RESULT

DelayMS 15000
    ADc_RESULT = ADIn 0
    Print At 2,1, "Temperature ", Dec ADc_RESULT
    HRSOut "Temperature:", Dec ADc_RESULT

DelayMS 13000
    ADc_RESULT = ADIn 0
    Print At 2,1, "Temperature ", Dec ADc_RESULT
    HRSOut "Temperature:", Dec ADc_RESULT

DelayMS 2000
    Print At 1,1, "Heart Beat: ", Dec hb_counter  // HEART BEAT
    HRSOut "Heart Beat: ", Dec hb_counter

DelayMS 5000

Wend
```

```
hb_receive:

Inc hb_counter
DelayMS 100
resume

Stop
///FOR ECG

Device 16F877A
XTAL 4

SERIAL_BAUD = 9600
RSOUT_PIN = PORTC.6
RSOUT_MODE = TRUE
RSIN_PIN = PORTC.7
RSIN_MODE = TRUE

ADCON1 = %00000001
Dim ADc_RESULT As Word

main:
WHILE 1=1
DelayMS 300
```

```
    ADc_RESULT = ADIn 0
    HRSOut Dec ADc_RESULT
wend
stop
```