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Health Care Services Based On Bio-Sensor and Intelligent Medicine Box

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Abstract:
Now a day's many countries are undergoing hospital restructuring by reducing the number of hospital beds and increasing the proportion of home healthcare. By doing so, the patients can get seamless healthcare at any time in a comfortable home environment. IOT technology provides the possibility to connect sensors, actuators or other devices to the Internet and is conceived 1as an enabling technology to realize the vision of a global infrastructure of networked physical objects. IOT extends the Internet into our everyday lives by wirelessly connecting various smart objects. In this Paper we use different modules such as LPC2148 controller, Temperature sensor and Heartbeat sensor at the patient end along with the LCD display which displays the medicine suggested by a doctor depending on Patient Health condition.

I.INTRODUCTION

In this Paper, here propose a Health Care Services Based on Bio-Sensor and Intelligent Medicine box. It consists of LPC2148 microcontroller Interfaced with the Heartbeat sensor and Temperature Sensor connected to the patient to read patient Health Conditions, It also interfaced with the 16X2 LCD Display which displays the Heartbeat and Temperature information of the patient.

Using GSM module, Patient Health Condition can be send to the Doctor. Also updates the data into the Server. Depending on the Patient Health Condition doctor can suggest the Medicine which is displayed on the 16 X 2 LCD displays that is placed at the patient. Doctor can be logged on to the Server at anytime from anywhere and can see the health condition of the patient for any particular period.

Internet of Things (IoT):

The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure creating opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. Each thing is uniquely identifiable through its embedded computing system.
The Internet of Things is the idea of everyday objects with network connectivity. So rather than just phones and computers being connected to the internet it would also be cars, washing machines, thermostats, televisions, street lights and just anything else. This connectivity would not only allow controlling them from afar but also allow them to communicate and share data with one another.

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 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 hearth pulses

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and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

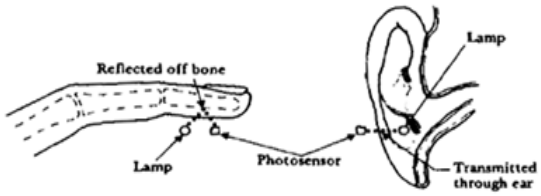
There are two types of photophlethysmography:

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.



Working of a Heartbeat Sensor

The basic heartbeat sensor consists of a light emitting diode and a detector like a light detecting resistor or a photodiode. The heart beat pulses causes a variation in the flow of blood to different regions of the body. When a tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects (a finger tissue) or transmits the light (earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in form of electrical signal and is proportional to the heart beat rate.

This signal is actually a DC signal relating to the tissues and the blood volume.

LM35 Temperature Sensor:

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). We can measure temperature more accurately than using a thermistor.The sensor circuitry is sealed and not subject to oxidation, etc.

The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified.

Features:

- Calibrated directly in o Celsius (Centigrade)
- Linear + 10.0 mV/oC scale factor
- 0.5oC accuracy guaranteeable (at +25oC)
- Rated for full −55o to +150oC 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, 0.08oC in still air
- Nonlinearity only ±1⁄4oC typical
- Low impedance output, 0.1 Ω for 1 mA load

II. RELATED WORK

GSM:

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS (Short Message Service).

AT Commands:

AT+CMGF = 1<ENTER>

This command is used to check whether modem supports text mode or not. If the modem responds with "OK" this mode is supported, using this mode it is only possible to send simple text message. It is not possible to send multipart, Unicode, data and other types of messages.

AT+CPIN = "0000"<ENTER>(replace 0000 with your PIN code)

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This command is used to setting up the modem. If the modem contains a SIM card which is secured with a PIN code, we have to enter this PIN code first. We have only 3 attempts to set the correct PIN code. After setting the PIN code, wait some seconds before issuing the next command to give the modem some time to register with the GSM network.

AT+CMGF=1<ENTER>

This command is used to send a SMS; the modem has to be put in SMS text mode first using this command.

Sending an Unicode SMS message

Some modems also have the capability to send Unicode or UCS2 messages without encoding a PDU. We can send Unicode messages by only converting the Unicode data to a HEX string and send this string to the modem.

AT+CSCS=?

This command is used to check whether modem supports Unicode SMS message mode or not. This command displays the codepages supported by the modem. The modem will respond like this:

+CSCS(“ GSM”,”PCCP437”,”CUSTOM”,”HEX”)

If this string contains “HEX” or “UCS2”, Unicode seems to be supported.

GPRS:

GPRS(General packet radio service) is a packet oriented mobile data service on the 2G and 3G cellular communication system’s global system for mobile communications. The GPRS core network allows 2G, 3G and WCDMA mobile networks to transmit IP packets to external networks such as the Internet. The GPRS system is an integrated part of the GSM network switching subsystem.

Services Offered:

GPRS extends the GSM Packet circuit switched data capabilities and makes the following services possible.

- SMS messaging and broadcasting
- “Always on” internet access
- Multimedia messaging service (MMS)
- Push to talk over cellular (PoC)
- Instant messaging and presence –wireless village
- Internet applications for smart devices through wireless application protocol (WAP)
- Point-to-Point (P2P) service: Inter-networking with the Internet (IP)
- Point-to-Multipoint (P2M) service: point-to-multipoint multicast and point-to-multipoint group calls

If SMS over GPRS is used, an SMS transmission speed of up to 30 SMS messages per min may be achieved. This is much faster than using the ordinary SMS over GSM, whose SMS transmission speed is about 6 to 10 SMS messages per minute.

Protocols supported:

GPRS supports the following protocols:

Internet protocol (IP):

In practice, built-in mobile browsers use IPv4 since IPv6 was not yet popular.

Point-to-point protocol (PPP):In this mode PPP is often not supported by the mobile phone operator but if the mobile is used as a modem to the connected computer, PPP is used to tunnel IP to the phone. This allows an IP address to be assigned dynamically (IPCP not DHCP) to the mobile equipment.

X.25 connections: This is typically used for applications like wireless payment terminals, although it has been removed from the standard. X.25 can still be supported over PPP, or even over IP, but doing this requires either a network-based router to perform encapsulation or intelligence built into the end-device/terminal; e.g., user equipment (UE).

When TCP/IP is used, each phone can have one or more IP addresses allocated. GPRS will store and forward the IP packets to the phone even during handover. The TCP handles any packet loss (e.g. due to a radio noise induced pause).

III. Working:

In this project, here propose a Health Care Services based on Bio-Sensor and Intelligent Medicine Box. It

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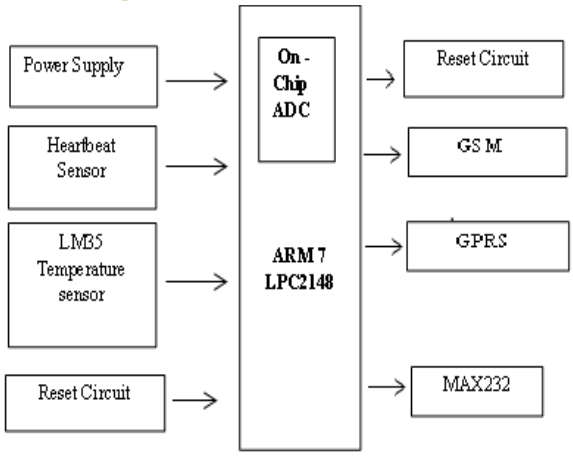
consists of a Heart Beat sensor connected to the patient finger to measure the heartbeat. When the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal. The output signal is also indicated by a LED which blinks on each heart beat.The output is active high for each beat and can be given directly to microcontroller.

LM35 is a basic temperature sensor that gives the readings in centigrade (degree Celsius) since its output voltage is linearly proportional to temperature.The output voltage varies by 10mV in response to every oC rise/fall in ambient temperature, i.e its scale factor is 0.01V/ oC. This temperature sensor is connected to ADC pin of LPC2148controller. As LPC2148 internally has an ADC, it converts the Analog signal of the temperature sensor output to the digital signals.

Here as prototype to give the patient information to the doctor it is provided with two GSM modules (SIM900A). One is operated as a GSM module when the patient health condition is displayed on the LCD module that is placed at the patient. Another module is operated as a GPRS when the patient health condition is updated in the Server.

Doctor can monitor the patient health condition at anytime from anywhere by logging in to the server. According to the patient Health condition doctor can suggest the medicine by simply giving an SMS which will be displayed on the LCD that is placed at the patient. That medicine will be displayed on the LCD continuously until another medicine is suggested by the doctor. This project uses regulated 5V, 1A power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

Block Diagram:



Hardware Implementation:

Hardware Components:

1. ARM7 LPC2148 Theory:

The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty.

Features:

• 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
• 8 to 40 kB of on-chip static RAM and 32 to 512 kB of on-chip flash program memory.128 bit wide

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interface/accelerator enables high speed 60 MHz operation.

• In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1 ms.

• EmbeddedICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip RealMonitor software and high speed tracing of instruction execution.

• USB 2.0 Full Speed compliant Device Controller with 2 kB of endpoint RAM. In addition, the LPC2146/8 provide 8 kB of on-chip RAM accessible to USB by DMA.

• One or two (LPC2141/2 vs. LPC2144/6/8) 10-bit A/D converters provide a total of 6/14 analog inputs, with conversion times as low as 2.44s per channel.

• Single 10-bit D/A converter provides variable analog output.

• Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.

• Low power real-time clock with independent power and dedicated 32 kHz clock input.

• Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities.

• Vectored interrupt controller with configurable priorities and vector addresses.

• Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.

• Up to nine edge or level sensitive external interrupt pins available.

Control Functions:

The System Control Block includes several system features and control registers for anumber of functions that are not related to specific peripheral devices. These include:

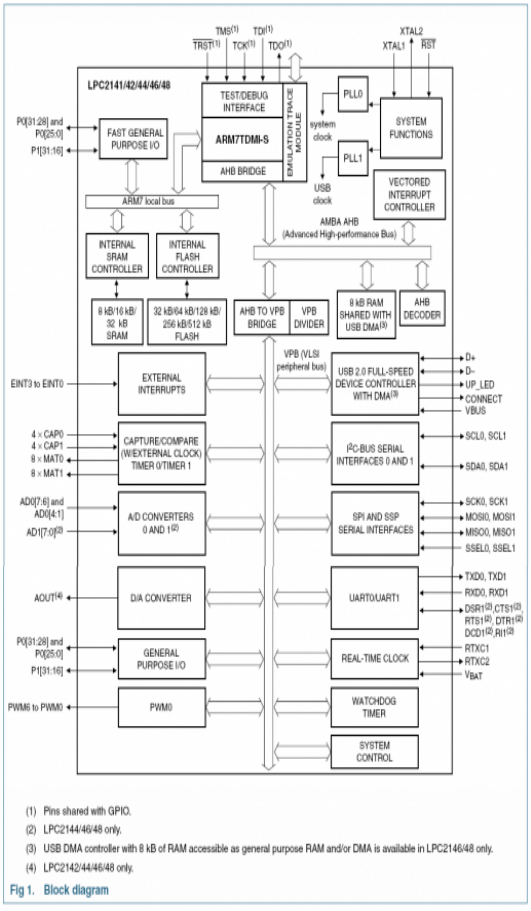
• Crystal Oscillator
• External Interrupt Inputs
• Miscellaneous System Controls and Status
• Memory Mapping Control
• PLL
• Power Control
• Reset
• APB Divider
• Wakeup Timer

Each type of function has its own register(s) if any are required and unneeded bits are defined as reserved in order to allow future expansion. Unrelated functions never share the same register addresses.

10-Bit ADC:

The LPC2141/42 contains one and the LPC2144/46/48 contains two analog to digital converters. These converters are single 10-bit successive approximation analog to digital converters. While ADC0 has six channels, ADC1 has eight channels. Therefore, total number of available ADC inputs for LPC2141/42 is 6 and for LPC2144/46/48 is 14.

Block Diagram of LPC2148:



(1) Pins shared with GPIO.
(2) LPC2144/46/48 only.
(3) USB DMA controller with 8 kB of RAM accessible as general purpose RAM and/or DMA is available in LPC2146/48 only.
(4) LPC2142/44/46/48 only.

Fig 1. Block diagram

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Pin Diagram of LPC2148:

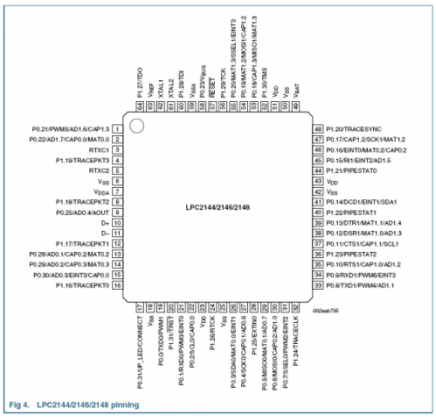

Fig 4. LPC2144/2146/2148 pinning

2) HeartBeat Sensor:

Heart beat sensor is designed to give digital output of heart beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute(BPM) rate. It works on the priniciple of light modulation by blood flow through finger at each pulse.

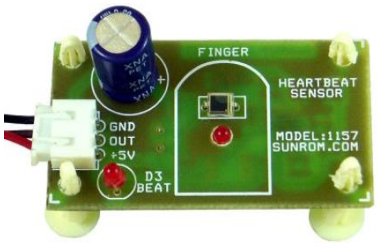

Fig 1 Heart Beat Sensor Circuit

Working:

The sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal. The output signal is also indicated by a LED which blinks on each heart beat.

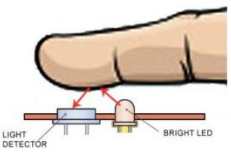

Fig2 : Working of a Heart beat sensor

The output is active high for each beat and can be given directly to microcontroller.

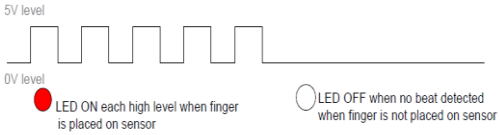

Fig3: Heart beat output signal.

3) Temperature Sensor(LM35):

LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature. The LM35 requires no external calibration since it is internally calibrated. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range.

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 thus has an advantage over linear 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.

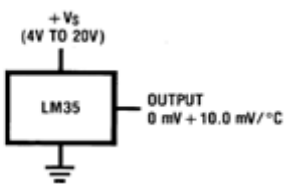

Fig 4: Temperature Sensor

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Characteristics of LM35 Sensor:

For each degree of centigrade temperature it outputs 10milli volts. ADC accepts the output from LM35 and converts that data into digital form which is sent to microcontroller for further processing.

Temperature Sensing Circuit:

The methods of temperature measurement may be divided into two main classes according as the exchange of heat between the testing body and the hot system takes place by contact or by radiation across a space. In the contact methods, thermometers or thermocouples are used and they are immersed in solids or liquids. The thermodynamic equilibrium between the hot body and the testing body is established by material contact. In the non-contact methods, the thermodynamic equilibrium is established by the radiation emitted as excited atom and molecules in the hot body return to the ground state.

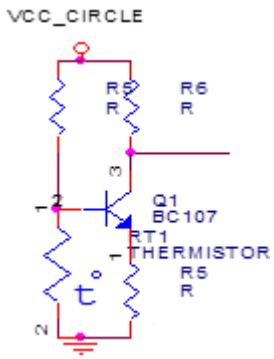


Fig 5: Temperature sensing Circuit

4) MAX 232 ---- Dual Driver/Receiver

Features:

•Operates from a single 5V Power Supply with 1.0uF Charge-Pump Capacitors
•Operates up to 120 k bit/s
•Two Drivers and Two Receivers
•±30 V Input Levels
•Low Supply Current . . . 8 mA Typical
•Upgrade with Improved ESD (15kV HBM) and 0.1uF Charge-Pump Capacitors is available With the MAX202.
•Applications-- TIA/EIA-232-F, Battery-Powered Systems, Terminals, Modems, and Computers

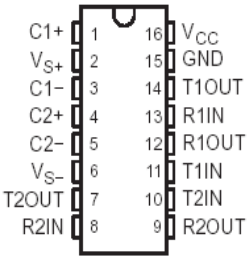
Description:

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5V supply. Each receiver converts TIA/EIA-232-F inputs to 5V TTL/CMOS levels. These receivers have a typical threshold of 1.3V, a typical hysteresis of 0.5 V, and can accept up to 30V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels.

MAX232 is primary used for people building electronics with an RS232 interface. Serial RS232 communication works with voltages (-15V ... -3V for high) and +3V ... +15V for low) which are not compatible with normal computer logic voltages. To receive serial data from an RS232 interface the voltage has to be reduced, and the low and high voltage level inverted. In the other direction (sending data from some logic over RS232) the low logic voltage has to be "bumped up", and a negative voltage has to be generated, too.

	RS232 Logic	TTL
High	-15 … -3V <->	+2V … +5V <->
Low	+3V … +15V <->	0V …+0.8V <->

Pin Diagram Of MAX232



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Function Table

EACH DRIVER

INPUT TIN	OUTPUT TOUT
L	H
H	L

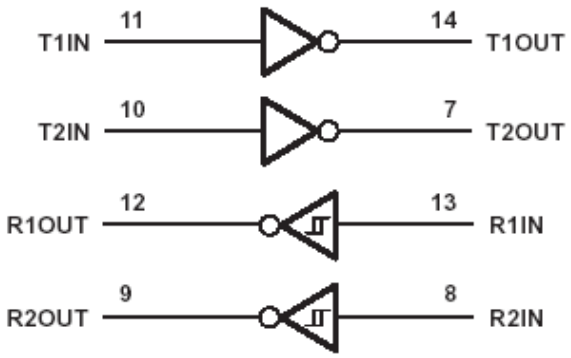
H = high level, L = low level

EACH RECEIVER

INPUT RIN	OUTPUT ROUT
L	H
H	L

H = high level, L = low level

Logic Diagram: (Positive Logic)



In this circuit the microcontroller transmitter pin is connected in the MAX232 T2IN pin which converts input 5v TTL/CMOS level to RS232 level. Then T2OUT pin is connected to reviver pin of 9 pin D type serial connector which is directly connected to PC.

In PC the transmitting data is given to R2IN of MAX232 through transmitting pin of 9 pin D type connector which converts the RS232 level to 5v TTL/CMOS level. The R2OUT pin is connected to receiver pin of the microcontroller. Likewise the data is transmitted and received between the microcontroller and PC or other device vice versa.

5. Crystal Oscillator:

On chip integrated oscillator operates with external crystal in range of 1 MHz to 25 MHz. The oscillator output frequency is called fosc and the ARM processor clock frequency is referred to as CCLK for purposes of rate equations, etc. fosc and CCLK are the same value unless the PLL is running and connected.

6. Reset Circuit:

Reset has two sources on the LPC2148: the RESET pin and watchdog reset. The RESET pin is a Schmitt trigger input pin with an additional glitch filter. Assertion of chip reset by any source starts the Wake up Timer (see Wake up Timer description below), causing the internal chip reset to remain asserted until the external reset is de asserted, the oscillator is running, a fixed number of clocks have passed, and the on chip flash controller has completed its initialization. When the internal reset is removed, the processor begins executing at address 0, which is the reset vector. At that point, all of the processor and peripheral registers have been initialized to predetermined values.

7. Power Supply:

The ac voltage, typically 220Vrms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltages regulator IC units.

8. Liquid Cristal Display:

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid

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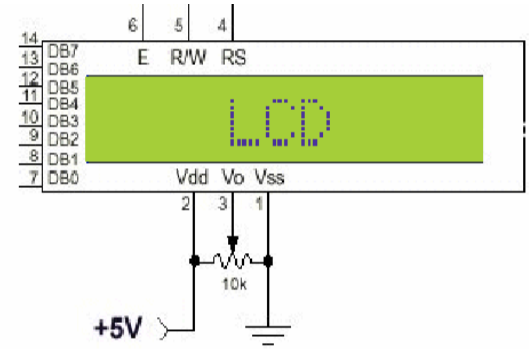
crystal twists the polarization of light entering one filter to allow it to pass through the other.

A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to an controller is an LCD display. Some of the most common LCDs connected to the contollers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

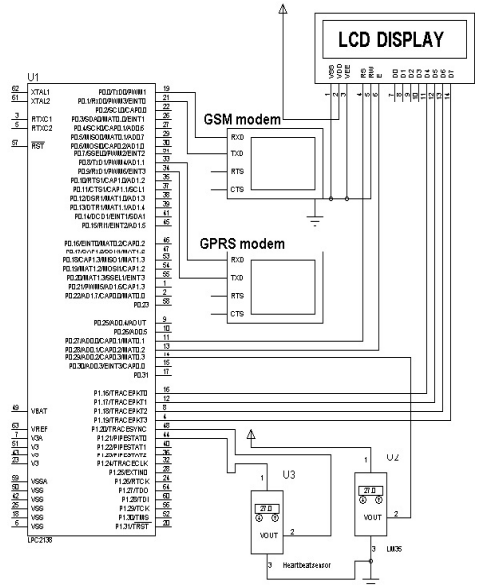
Pin Description:

Most LCDs with 1 controller has 14 Pins and LCDs with 2 controller has 16 Pins (two pins are extra in both for back-light LED connections).



PIN	SYMBOL	FUNCTION
1	Vss	Power Supply(GND)
2	Vdd	Power Supply(+5V)
3	Vo	Contrast Adjust
4	RS	Instruction/Data Register Select
5	R/W	Data Bus Line
6	E	Enable Signal
7-14	DB0-DB7	Data Bus Line
15	A	Power Supply for LED B/L(+)
16	K	Power Supply for LED B/L(-)

Schematic Diagram of Health Care Services Based on Bio-Sensor and Intelligent Medicine Box:



ADVANTAGES:

- Easy to operate
- Can Monitor from any where
- Simple and Reliable Design

APPLICATIONS:

- Medical Application
- Health Care Services

IV.TEST AND RESULT

A .Experimental ResultDiagram of Health Care Services Based on Bio-Sensor and Intelligent Medicine Box:

SI.NO	DATE	Data1	Data2	Data3	Data4
0	2015-09-16 01:40:48	H.B:	74	Temp:	23
1	2015-09-16 01:41:26	H.B:	66	Temp:	28
2	2015-09-16 01:41:57	H.B:	72	Temp:	28
3	2015-09-20 18:13:40	H.B:	68	Temp:	26
4	2015-09-20 18:14:48	H.B:	71	Temp:	32
5	2015-09-20 18:15:56	H.B:	66	Temp:	30
6	2015-09-20 18:17:06	H.B:	67	Temp:	29
7	2015-09-20 18:29:48	H.B:	69	Temp:	29
8	2015-09-20 19:01:10	H.B:	74	Temp:	30
9	2015-09-20 19:02:34	H.B:	71	Temp:	32
10	2015-09-20 19:03:52	H.B:	68	Temp:	25
11	2015-09-20 19:05:06	H.B:	66	Temp:	25

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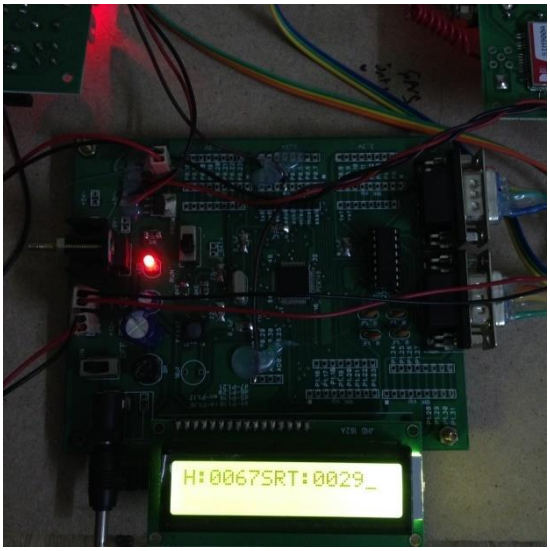
B) Initially it displays a message that indicate to store the mobile number of to which we need to send the patient health condition.

C) Heart Beat and Temperature information of the Patient displays on the LCD Display.



D) Medicine Suggested by the doctor displays on the LCD Display.

Overview:

V.CONCLUSION

Doctor can Monitor Patient Health Condition from anywhere at any time. We can send patient health parameters like heart beat and temperature to doctor's mobile directly. Doctor can suggest the medicine depending on patient health condition which can displayed on the LCD placed at the patient side. This information also be upload into the server so that doctor can monitor for any particular period of time and can identify the changes in patient health condition from time to time. We can create different login ID's for different patients so doctor can access no.of patients details and can decide to whom he should treat first.

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