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PATIENT HEALTH MONITORING SYSTEM WITH LOCATION DETAILS BY GPS OVER GSM

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Abstract — The main intention of this project is to design a system which is capable to monitor body's parameters continuously. Another intention is to track patient's current location using GPS. Thus, it sends message to the concerned authority by SMS using GSM. This project uses a microcontroller of the 8051 family and a rectified power supply. In this system, the GPS and GSM modem are interfaced to the microcontroller with the MAX-232 device for communication with the unit. A digital temperature sensor, blood pressure along with heartbeat sensor are duly interfaced to the microcontroller to act as monitoring of the patient's body temperature. A 16*2 LCD display is interfaced to the microcontroller for displaying the information locally. Whenever the body's one of these ailments exceeds the set point, then the microcontroller processes the details and sends them to the concerned authority by an SMS through the GSM modem. The location of the person is also sent with the help of the GPS providing longitude and latitude values. The sending and receiving information is also displayed on the LCD.

Keywords-Patient, Blood Pressure, Heartbeat, Temperature, GSM, GPS.

I. INTRODUCTION

The primary goal of this system is to make a device that can monitor the ailments of the patient and inform them to the concerned personnel, without any human interaction. This process is done with the help of GSM technology. Today we can see that, doctors are found busier and sometimes they could not provide sufficient time to diagnosis each and every patient at the right of time if patients needs his help in order to take some necessary action to save his/her life. In critical conditions like children patient, coma patient, burnt patient in this type of conditions, nurse cannot go often to patients' room because it may create some disturbances. As well as in case of aged persons, they cannot go often to regular check-up. So they should be treated at home by some monitoring devices.

Here we have tried to introduce our device that can monitor the patient's ailments continuously and generate and send an SMS to the concerned authority. The ailments that our project can monitor are Temperature, Blood pressure and Heartbeat through different sensors. Both blood pressure and heartbeat sensor are included in single sensor and both gives output result in digital form whereas the temperature sensor gives an analogue output which are after converted into digital data using analogue to digital converter. Collected data are then sent to the Microcontroller. Here microcontroller's function is to show the latest readings on interfaced LCD and continuously compare the reading with the preset set points. If any emergency takes place such as changing of monitored ailments outside the range, microcontroller will transmit data over the air by means of GSM modem in order to send the information along with the present location of the patient using GPS. From the transmitter, information is sent as an SMS to care taker or the expert. Here not only the information sends by GSM modem but also the same readings are displayed on interfaced LCD.

II. WORKING

The project microcontroller 8051 family along with appropriate sensors, GPS for tracking the location of patient and GSM for sending an SMS. All these requires +5V DC supply to operate except GPS which will require +12V DC supply. For this, we have used 230V/12V step down transformer which will give AC 12V and further LM7805 along with the 4 diodes connected in bridge connection in order to get rectified that means AC to DC converted +5V supply. Whereas the GPS will directly receive +12V DC supply.

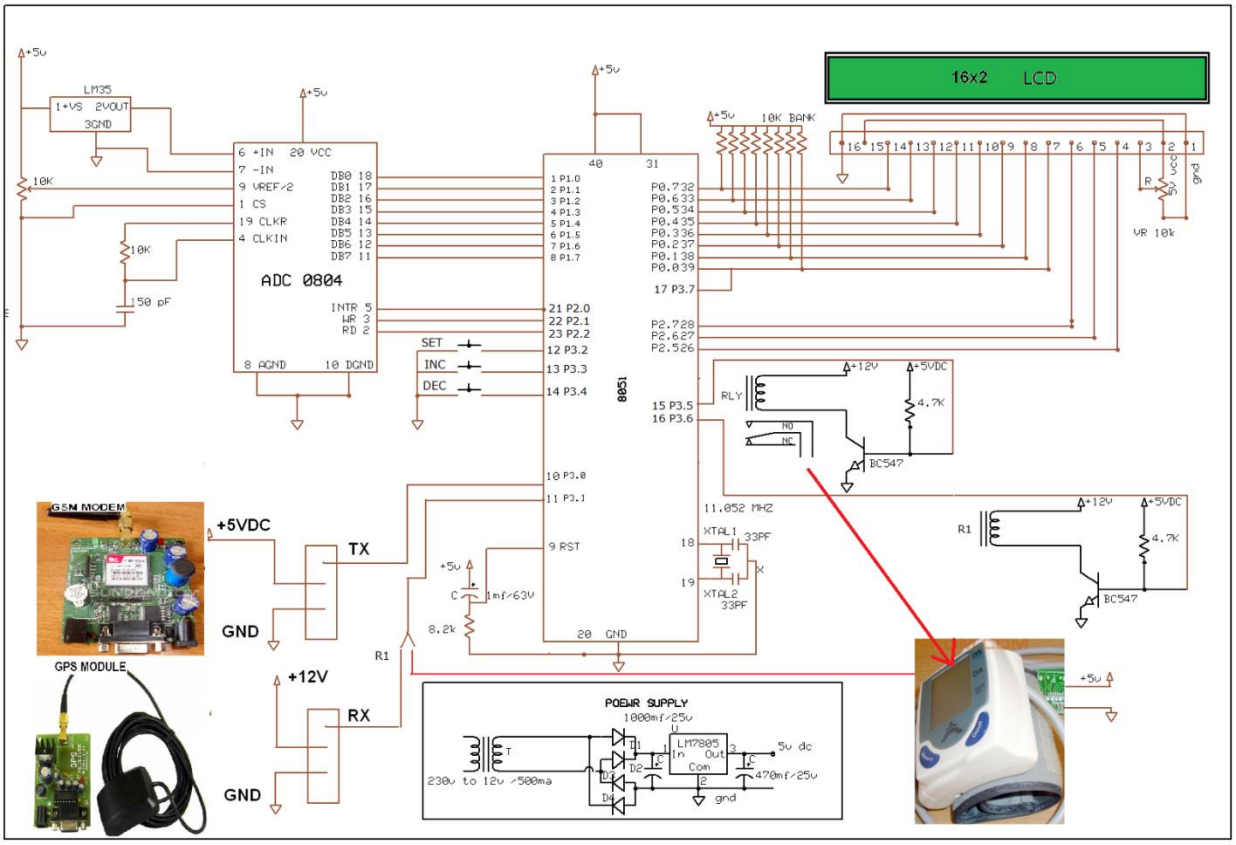

Fig.1 Circuit Diagram of Working Model

For the measurement of temperature, we have used LM35 IC which gives analogue reading continuously to the microcontroller. But microcontroller cannot read the analogue signal, so we used ADC0804 to convert the analogue readings into binary data and output of ADC is given to port-1 of microcontroller. Here microcontroller will start writing temperature reading on LCD until it gets all the necessary readings of Blood pressure and Heartbeat. In this case, blood pressure sensor uses Rx pin of microcontroller whereas GSM uses Tx pin. But in here GPS also uses Rx pin. Therefore, we have to use one relay which will give Rx pin to both the blood pressure sensor and GPS according to usage. That means when Blood Pressure is ready to give readings to microcontroller Rx pin will be given to Blood Pressure Sensor and when in case of emergency and microcontroller is about to take location readings from GPS, relay contacts will trip to GPS module that means Rx pin will be given to GPS. Here we have also used another relay to start and stop the Blood Pressure measurement automatically. The buttons are given to change the set points of each ailments measurement individually. Blood Pressure sensor gives the output in cyclic manner therefore microcontroller is functioned to segregate all the data and to compare them with respective set points. If the one of the patient's ailments falls to outside of the range of selected set points region, then the microcontroller will trip the relay for sending SMS through GSM. For sending SMS microcontroller is programmed to switch GSM module in SMS form and it will type the message in prescribed manner and send it to saved number that means to concerned authority along with the location details.

2.1 Main Components

A. Micro Controller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

B. Blood Pressure Sensor

Reads blood pressure and heart rate and outputs at 9600 baud rate. Blood Pressure & Pulse reading are shown on display with serial out for external projects of embedded circuit processing and display. Shows Systolic, Diastolic and Pulse Readings. Compact design fits over your wrist like a watch. Easy to use wrist style eliminates pumping.

C. Temperature Sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 μA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range.

D. GSM

GSM, the Global System for Mobile communications, is a digital cellular communications system, which has rapidly gained acceptance and market share worldwide, although it was initially developed in a European context. In addition to digital transmission, GSM incorporates many advanced services and features, including ISDN compatibility and worldwide roaming in other GSM networks. The advanced services and architecture of GSM have made it a model for future third-generation cellular systems, such as UMTS. This paper will give an overview of the services offered by GSM, the system architecture, the radio transmission.

2.2 Auxiliary Components

A. ADC

Normally analogue-to-digital converter (ADC) needs interfacing through a microprocessor to convert analogue data into digital format. This requires hardware and necessary software, resulting in increased complexity and hence the total cost. The circuit of A-to-D converter shown here is configured around ADC 0808, avoiding the use.

B. MAX 232 & RS 232

The RS232 standard is not TTL compatible; therefore, it requires a line driver such as the MAX232 chip to convert RS232 voltage levels to TTL levels, and vice versa. The interfacing of 8051 with RS232 connectors via the MAX232 chip is the main topic. The 8051 has two pins that are used specifically for transferring and receiving data serially. These two pins are called TXD and RXD and a part of the port 3 group (P3.0 and P3.1). pin 11 of the 8051 is assigned to TXD and pin 10 is designated as RXD. These pins are TTL compatible; therefore, they require a line driver to make them RS232 compatible. One such line driver is the MAX232 chip. Since the RS232 is not compatible with today's microprocessors and microcontrollers, we need a line driver (voltage converter) to convert the RS232's signals to TTL voltage levels that will be acceptable to the 8051's TXD and RXD pins. One example of such a converter is MAX232 from Maxim Corp. The MAX232 converts from RS232 voltage levels to TTL voltage levels, and vice versa.

III. RESULT ANALYSIS

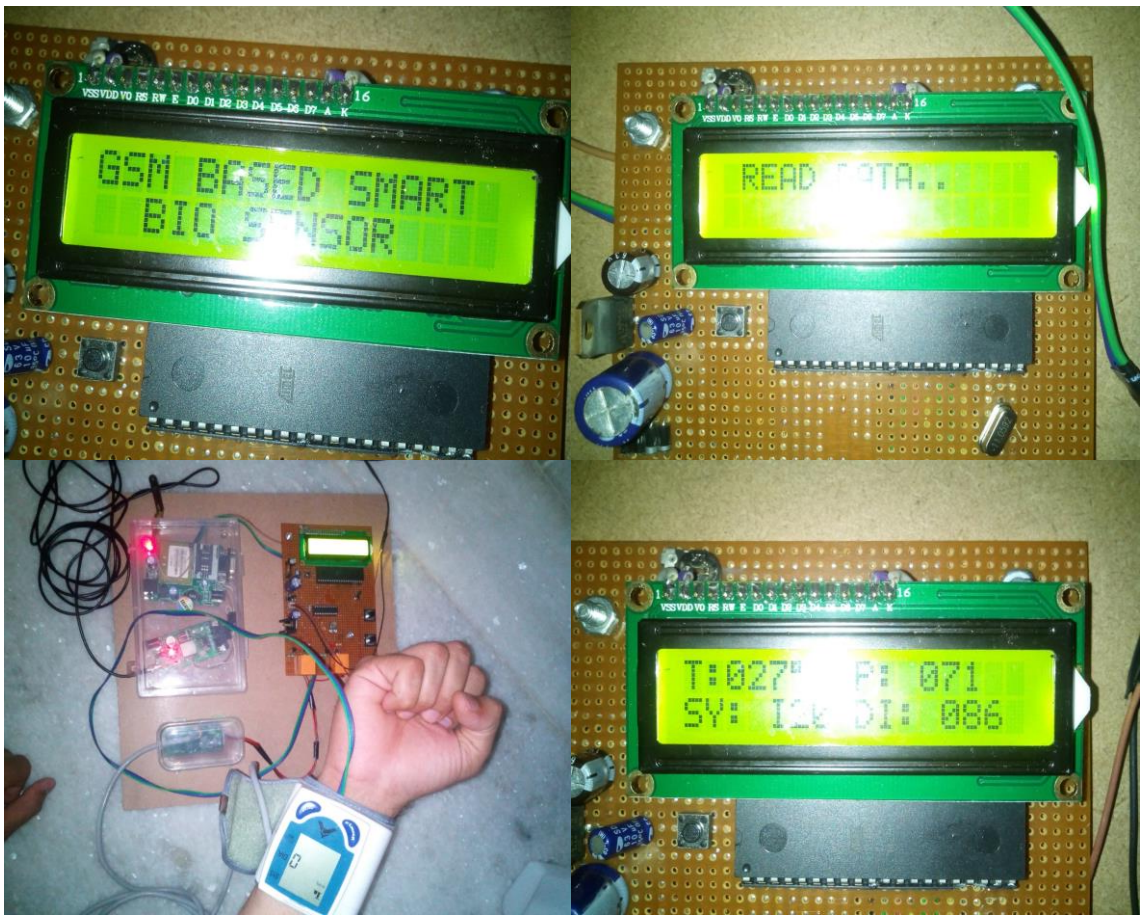

Fig.2. Procedure of Model

The reading taken in the normal condition gives brief information such as current temperature (T), Pulse rate (P), Systolic (SY) and Diastolic (DI) with appropriate units. Now, for the practical condition we cannot create abnormal condition such increasing/decreasing the blood pressure/pulse rate measurements. Hence we have tried to lowering the default set point values and done the same procedure mentioned as above. Thus in these manner of abnormal condition the system detects the undesirable changes in the ailments of the patients and tracks location details by GPS in order to send message. The message briefly says information about patient's condition in particular manner. In order to test system in abnormal condition, we have kept our temperature sensor LM35 near the hot object, in this case, boiled water. So we received a text message for the abnormal condition on the feeded number. The message gives all the necessary ailments information along with the GPS location details that are described as Latitude(LAT) and Longitude (LON) where the N in Latitude measurement stands for North direction and E in longitude stands for East direction.

IV. CONCLUSION

This technique presents a system to upgrade existing health monitoring systems in the hospitals by providing monitoring capability and a thus a better cure. This system is based upon microcontroller providing low cost effective solution. It provides continuous monitoring of the vital signs of the patient over long periods of time until an abnormal condition is captured and hence critical situations can be overcome. This intelligent monitoring system provides long term monitoring capability useful for the staff in the hospitals and reduces their workload. Future work may include more number of sensors in a single system to provide flexibility. Hence the main goal of this paper is to develop a patient health monitoring system to alert the staff in the hospitals so that immediate care is provided to patients. The proposed technique has the following advantages

• Easy and Reliable for Doctors: In a hospital, either the nurse or the doctor has to move physically from one person to another for health check, which may not be possible to monitor their conditions continuously. Thus any critical situations cannot be found easily unless the nurse or doctor checks the person's health at that moment. This may be a strain for the doctors who have to take care of a lot number of people in the hospital.

• Increase efficiency: The number of nurses required for keeping a check on patients in ICU can be reduced to a large extent.

• More Accurate: Chances of human error in checking different health parameters is also reduced, also the database can be updated time to time.

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