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The Intelligent Patient Monitoring System with Wireless Network

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Abstract: ***Now a day's whole hospital doctors are facing lot of problem with nursing staff for maintaining all vital parameters monitoring and recording time to time. In this project we have implemented a complete automatic wireless based monitoring & recording vital parameters of patient like heartbeat, body temperature, emergency request measuring through embedded systems using AT89C52 Microcontroller, ADC0809 8 bit 8 channel ADC and Sensors, LCD display. Here the program written in microcontroller reads the data from all sensors and display on 16*2 LCD dot matrix display and the same data is transferred through wireless transmitter. We are adding one more facility the control system raises alarm if any one of the parameters exceeds beyond the normal values. The main controller unit will send those sensed data of that patient by the help of Global system mobile (GSM) Module to the observer/doctor. The observer/doctor can receive the SMS sent by GSM module and further decision can be taken. The message is sent to a mobile phone using GSM Modem. This is a low cost project for monitoring patient data with respect to date and time without fail and it becomes easy to analyze the graphical representation of patient data.***
Keywords: GSM, ADC0809, wireless sensor networks, AT89C52

I. INTRODUCTION

Now a day's whole hospital doctors are facing lot of problem with nursing staff for maintaining all vital parameters monitoring and recording time to time. In this project, we have implemented a complete automatic wireless based monitoring & recording vital parameters of patient like heartbeat, body temperature, emergency request measuring through embedded systems using AT89C52 Microcontroller, ADC0809 8 bit 8 channel ADC and Sensors, LCD display. Here the program written in microcontroller reads the data from all sensors and display on 16*2 LCD dot matrix display and the same data is transferred through wireless transmitter [1]. We are adding one more facility the control system raises alarm if any one of the parameters exceeds beyond the normal values. The main controller unit will send those sensed data of that patient by the help of GSM Module to the observer/doctor. The observer/doctor can receive the SMS sent by GSM module and further decision can be taken. The message is sent to a mobile phone using Global system mobile (GSM) Modem. This is a low-cost project for monitoring patient data with respect to date and time without fail and it becomes easy to analyse the graphical representation of patient data.

During the last quarter of the century, there has been a tremendous increase in the use of electrical and electronic equipment in the medical field for clinical and research purpose. In medical instrumentation, the main function is to measure or determine the presence of some physical quantity that may be useful for diagnostic purposes. Therefore, many types of instrumentation systems are used in hospitals and physicians clinics. The primary purpose of medical instrumentation is to measure or determine the presence of some physical quantity that may assist the medical personnel to make better diagnosis and treatment.

Accordingly, many types of instrumentation systems are presently used in hospitals and other medical facilities. Certain characteristic features, which are common to most instrumentation systems, are also applicable to medical instrumentation systems [2]. In the broadest sense, any medical instrument would comprise of the following four basic functional components: input parameter, Transducer/Sensor, Signal conditioner and display system.

Patient monitoring system in all ICUs is the most needed and essential device for monitoring the patient's vitals. As the physicians cannot stay next to the patients for all time round the clock, we go up for the wireless patient monitoring and tracking system, to have a quantitative assessment of the important physiological variables of the patients. Monitoring systems are used for measuring continuously or at regular intervals, automatically, the values of the patients important physiological parameters. The choice of proper parameters, which have high information content, is an important issue in the patient monitoring system.

The important parameters are ECG, heart rate, pulse rate, blood pressure, body temperature, respiratory rate and SPO2. Wireless telemetry permits examination of the physiological data of human under normal conditions and in natural surroundings without any discomfort or obstruction to the person under investigation. This system consists of simple and low cost components that are

capable of processing real time temperature, heart rate and transmitting the same. There exists a demand for such a system, as current implementations are complex to use and high in cost. Our system design aims to provide solutions to the problem encountered in acquiring temperature and heart rate from the subject, as well as providing remote transmission of the data. All papers which we followed states that, patient is stationary and the observer in a remote location. The availability of the patient stationary can be possible to make a good hardware and software development is possible. The main aim of our work is to show how persons suffering from cardiovascular and other hypertension disease can directly monitor their physiological parameters without effecting to their daily activities by using the GSM.

II. LITERATURE SURVEY

A heart rate monitor is a personal monitoring device which allows one to measure his or her 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. It is widely used in hospitals for checking the health of patient(s). These monitors are very useful in realizing the health conditions of the person according to the age group.

There is no doubt about the usefulness of a heart rate monitor. Every time someone visits a doctor, one of the first things the doctor checks is the patient's heart rate or say pulse rate. In medical terms the heart rate of a patient is useful in determining many of his/her medical conditions [3]. There are many heart rate monitoring systems already present. But our monitoring system has certain advantages over the already present systems. The stethoscope which is the most basic device used by doctors is not very accurate. Another way is to use electrocardiogram, but it is supposed to be very costly and not user friendly. The heart rate monitor that we have setup does not need any expert advice, since it directly shows the value of heart rate on LCD. Also it is portable, so can be carried along to places that one travels too. Its cost effectiveness is also an advantage.

This is the basic principle of our author's paper. Photoplethysmography is the process of optically estimating the volumetric measurement of an organ. Pulse oximetry, cardiovascular monitoring, respiration detection, heart rate monitoring etc are few common applications of photoplethysmography. Let us have a look at the application of photoplethysmography in heart rate monitoring from the fingertip. When the heart expands (diastole) the volume of blood inside the fingertip increases and when the heart contracts (systole) the volume of blood inside the fingertip decreases.

The resultant pulsing of blood volume inside the fingertip is directly proportional to the heart rate and if you could somehow count the number of pulses in one minute, the heart rate in beats per minute (bpm). For this an IR transmitter/receiver pair placed in close contact with the fingertip. When the heart beats, the volume of blood cells under the sensor increases and this reflects more IR waves to sensor and when there is no beat the intensity of the reflected beam decreases. The pulsating reflection is converted to a suitable current or voltage pulse by the sensor [4]. The sensor output is processed by suitable electronic circuits to obtain a visible indication (digital display or graph) [5].

III. HARDWARE DESCRIPTION

The Block diagram is designed to detect the temperature and heartbeat of a person and send SMS to the register mobile number (Fig. 1). For this we used mainly a microcontroller i.e.. AT89C52 which is having a features of 3-level program memory lock, 256*8 bit Internal RAM, 32 programmable I/O lines, 2 16 bit timer/counters, 5-vector two level Interrupt architecture, low power idle , power down modes, full duplex serial port, on-chip oscillator and clock circuitry. The on chip flash has a feature of reprogramming i.e.. Conventional non-volatile memory programmer. When RAM, timer/counters, serial port and interrupt system are functioning the idle mode stops the CPU. By freezing the oscillator and disabling all other chip functions until the next hardware reset RAM content is saved by power down mode.

AT89C52 contains mainly 4ports. Port 0 is an 8-bit open drain bidirectional I/O port which receives the code bytes during flash programming and outputs the code bytes during program verification. Port 1 is an 8-bit bidirectional I/O with internal pull-ups which receives the low order address bytes during flash programming and verification [6]. Port 2 is an 8-bit bidirectional I/o port with internal pull-ups but receives the high order address bits and some control signals during flash programming and verification. Port 3 is an 8-bit bidirectional I/O port with internal pull-ups which receives some control signals for flash programming and verification [7][8].

To run any part we need power supply so it is consider as primary requirement. The power supply is used to recharge the units. We use center tapped secondary transformer of 12v-0v-12v. In order to communicate with micro controller we need ADC , the ADC used in this project is ADC0809. It is monolithic CMOS device with 8- bit analog to digital converter, 8-channel multiplexer and

microprocessor compatible control logic. For this temperature sensor is input and it converts the value and given to microcontroller [9].

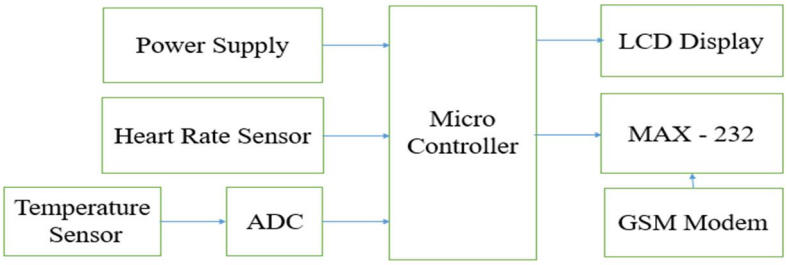

Fig 1. Block diagram of the intelligent patient monitoring system through wireless networks

To communicate GSM Modem with microcontroller we need MAX 232C. It is an integrated circuit which is used to convert signal from a serial port ie. RS 232 to signal suitable for use TTL-compatible digital logic circuits. MAX 232 is a dual transmitter/receiver which is used to convert the Rx, Tx, CTS(Clear To Send), RTS (Request To Send) signals. To send the SMS via AT command we will use GSM modem ie.. SIM 900 in this project which works on 9600 bps. It is used as a communication devices used to modulate analog carrier signal with digital data and transmit, vice versa.GSM is used for reading, writing, sending, receiving and deleting SMS via AT commands.

Finally to see the output we need display ie.. LCD display of 16*2 parallel operated dot matrix is connected to micro controller of port-0 and port-2. In that data pins ie.. D0to D7 are connected to port-0, P2.7 is connected to register select, P2.6 is connected to Read/Write and P2.5 is connected to enable pin of LCD display [10][11].

IV. EXPERIMENTAL RSULTS

In the project we are using thermistor for measuring body temperature. In order to get the contact from body we use any external devices. When a person touches the external device (Fig.2) ie.. Clip it will measure the body temperature and heart beat per minute. Here we will use LCD display and panic button and buzzer for output. As soon as it senses the temperature and heart beat rate it will display on the LCD and buzzer will get on. In order to send the message to doctor we will use panic button. If the panic button is on the person receives the SMS through the GSM Modem to the register mobile. If body temperature changes more drastic the person receives the SMS to the register mobile.TM on temperature indicates the body temperature and HBEAT/Min (Fig.3) represents the heat beat rate per minute (Fig.4). The samples of patients represented in figure. (Fig. 5).

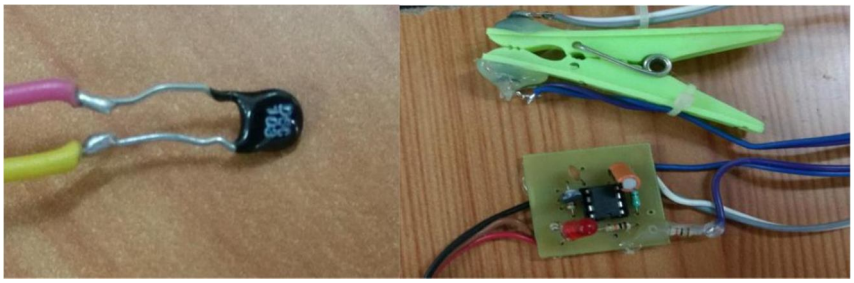

Fig 2. Temperature sensor (thermistor) and heart rate sensor and circuit

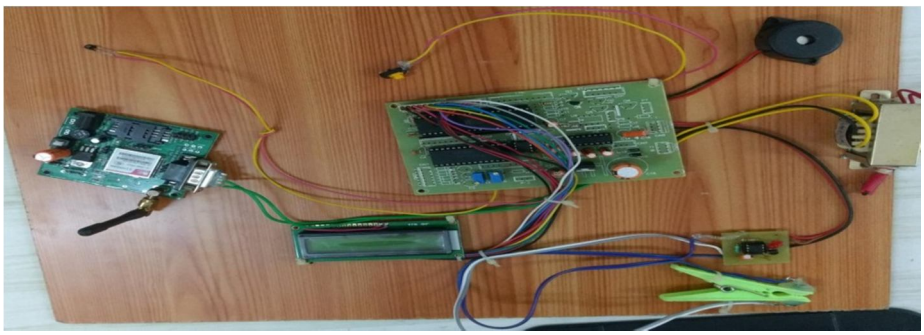

Fig 3. Experimental setup of intelligent patient monitoring system

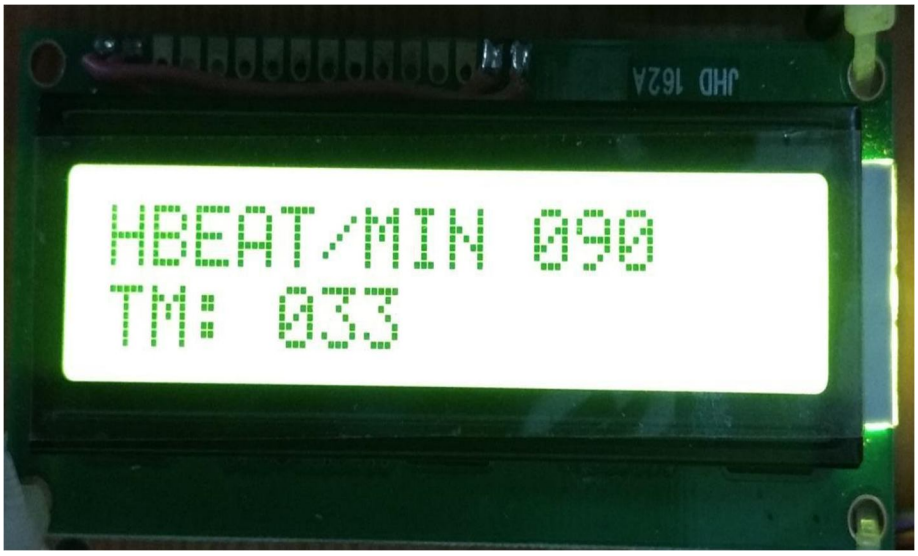

Fig 4. Heartbeat per min & temperature displayed on the LCD screen

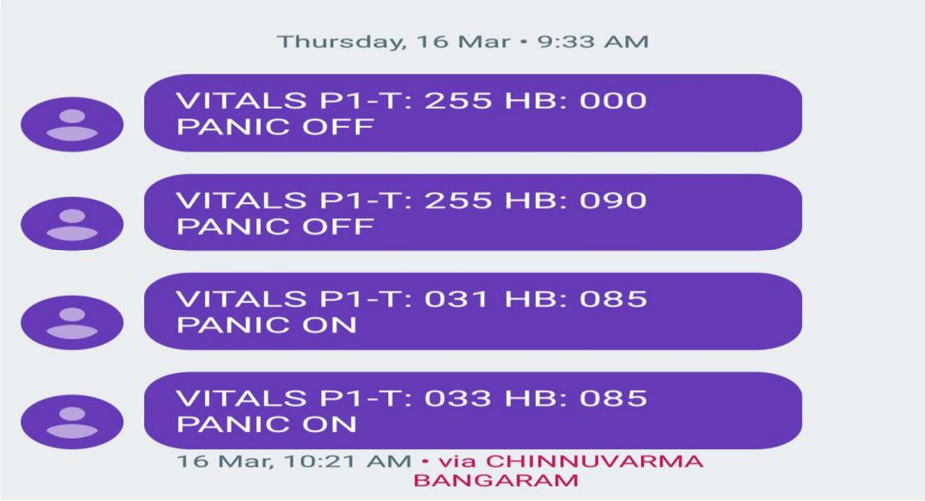

Fig 5. Samples of hardware output

V. CONCLUSION

The importance of our paper is to monitor the patient condition at any place and information must send to the doctor. Now a day's its very economical to stay in hospitals for long time and time will also lapse. So it is one of the best methods for bio medical application to get the patient condition from any place. Hence proper and timely Medicare to the patient can be given so that percentage of death can be reduced to larger extent.

It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC"s and with the help of growing technology the project has been successfully implemented. The Whole health monitoring system, which we have proposed can be integrated into a small compact unit as small as a cell phone or a wrist watch. This will help the patients to easily carry this device with them wherever they go.

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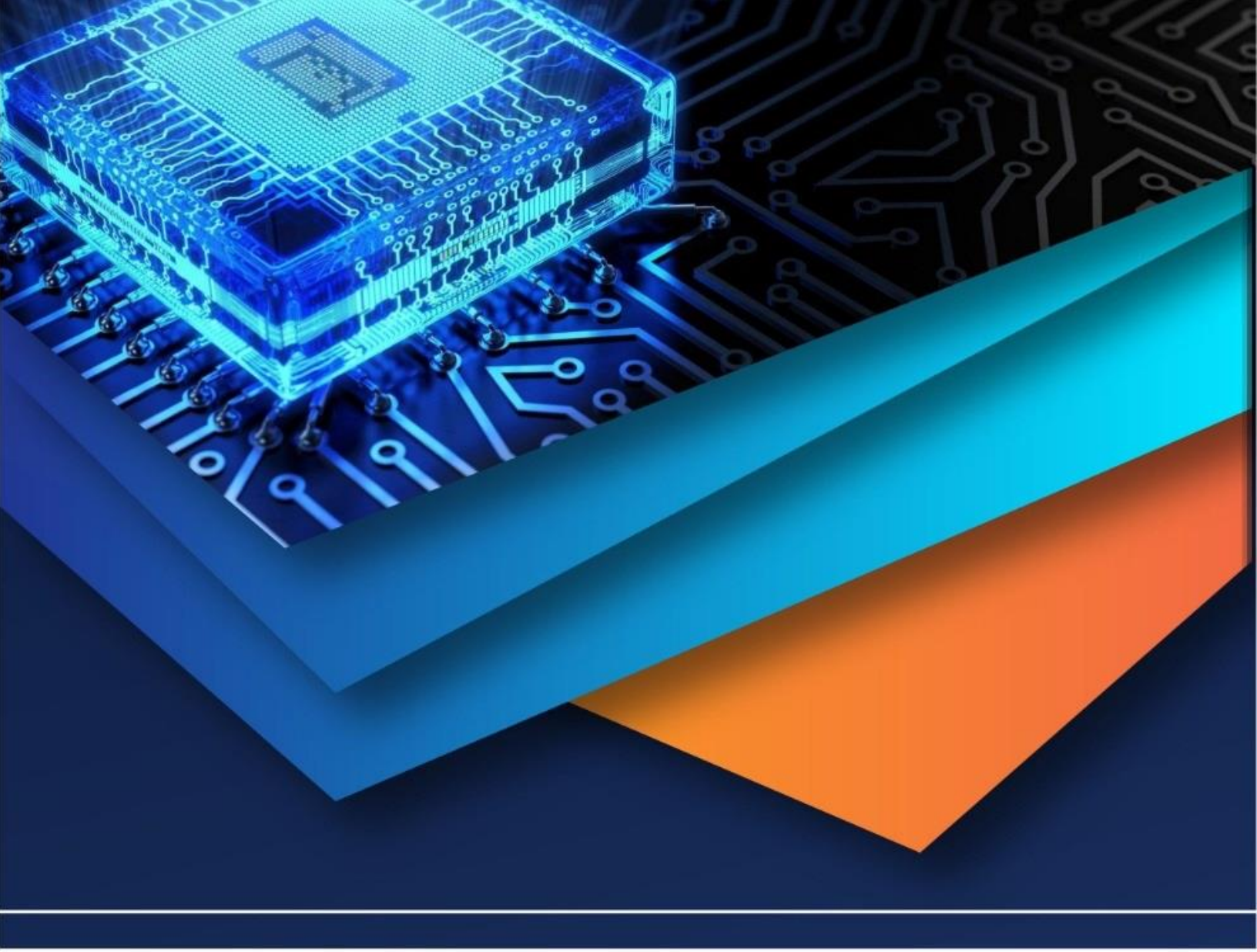

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