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SPECIAL ISSUE ON RECENT RESEARCH CHALLENGES IN BIO-MEDICAL APPLICATIONS

Telemedicine Consultation Using Arm for Monitoring Vital Signs of Heart Patients at Home

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Telemedicine consultation system proposed a model to solve the medical assurance problem of monitoring patients at home. Here the proposed system has a model of three subsystem which are frontend diagnostic system, patient's diagnostic system, hospital monitoring system. It emphasizes the software and hardware realization of embedded diagnostic system, analyses the collection process of temperature, BP, blood oxygen saturation level, ECG and automatic call generation under the co-ordination of ARM system, GPRS module, GSM module and vital signs information collection module in real time which helps to give first aid. Here an alarming unit is also added to indicate the emergency and to indicate the time of giving medicine to patient.

Key words: Telemedicine consultation, ARM, GSM, home monitoring.

Telemedicine consultation is one of the fast growing medicinal system in world. The main purpose of telemedicine consultation system is to treat the remote patients effectively. In this system patient consultation is done through video conferencing, patients living in the remote areas consults and gets prescription from the doctor in high level hospitals via internet. This is how the telemedicine consultation makes the medical facilities available even in far remote areas with the help of technology.

Medical assurance is one of the main focus now a days. Patients faces three main problem of more expense in getting hospitalized and often faces the situation that they have to be transferred to hospital immediately in case of emergency and the third problem is that monitoring the patients physiological conditions regularly at home. These problems are solved in the proposed system.

The whole telemedicine system includes several subsystems such as telemedicine consultation system, telemedicine education system and multimedia health-care consulting system etc. This paper discusses design of telemedicine consultation system which is the most important part and realizes its partial function in embedded system. Here the proposed system makes use of sensors for monitoring the physiological conditions, it also uses GSM and GPRS to communicate the patients address to ambulance, case of emergency to relatives and family doctor automatically.

Overall design

Objective

In this paper, telemedicine consultation system for monitoring patients in home is discussed. This system includes monitoring of various vital signals of the patient, in order to monitor these various vital signals we are using different sensors such as ECG sensor, Blood

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Pressure sensor, Pulse oximeter, oxygen level sensor.

This system uses microcontroller ARM7-LPC2148 for controlling the system operation. The controller unit collects the information from all the sensors and process it. The threshold value for each sensors are programmed. The controller processes the information from each sensors and check it with the programmed threshold value, if the sensor value is greater than the threshold value, then the controller gives specific commands of operation to take place which we already programmed. After processing the information from the sensor, the control unit sends the data to display and then stores it.

Here in this system we can configure the phone numbers of relative, doctor and also the address of the patient for providing immediate help in case of emergency. This system includes keypad for configuring the address and phone numbers. It also includes GSM module for making phone call and sending message to the ambulance.

Hardware design

The Telemedicine Consultation System consists of ARM7 microprocessor , sensor unit , display unit, power supply unit, GSM in the front end diagnostic system. The microprocessor gets the vital signs information from the patient through the sensors and based on this information ,it controls the monitoring functions.

Block Diagram

The block diagram of the Telemedicine Consultation System is shown in the following figure. It consists of sensor unit, display unit, microprocessor, GSM module. Here the microprocessor and GSM is connected through MAX232

Fig. 2.1. Telemedicine Consultation System

Microcontroller

The ARM7TDMI-S is a 32-bit microcontroller based on RISC architecture. It offers high performance for low power consumption. It uses three stage pipelines to increase the speed of the flow of instruction. The three stages are fetching, decode and execute. This controller is used to control the monitoring process by collecting datas from sensors and to take necessary control functions.

Sensors Unit

Sensor units consists of various sensors that is used to get vital signs information from the patient. Temperature sensor is used to monitor temperature. Pressure sensor is used to monitor the oxygen level in oxygen cylinder. Pulse oximeter is used to monitor the oxygen saturation level in blood. ECG sensor module is used to monitor the ECG. Blood pressure sensor module is used to monitor BP. This unit continuously sends the datas to the microprocessor unit which checks these values with the preset threshold values.

Display unit

Graphical LCD display unit is used to display the datas sent to microprocessor by the sensors. GLCD is used for the graphical representation of the ECG. GLCD is mainly used for pictorial representation .GLCD(JHD12864) displays 8 lines with 21 characters in each line.

GSM Communication

Here GSM(SIMCOM300) unit is used to send SMS and generate automatic call to the doctor and patient's relatives in case of emergency. It is also used to generate automatic call to the ambulance in case of emergency. Initially patient's address and phone number is configured through keypad. In case of emergency, it generate automatic

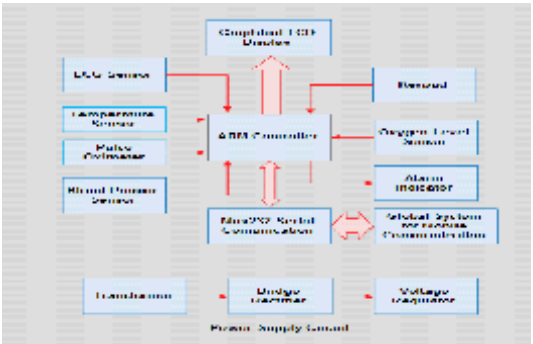

Fig. 3.1. Functional block diagram

call and send the patient's address via SMS to the ambulance. It helps to send the collected information to the doctor at regular period of interval. MAX 232 is used for communication between GSM and microprocessor

Overview of the software

Keil Micro-Vision is Windows based front end software for the C compiler and macro assembler linker/locater and hex file generator developed for the ARM controller.

Proteus is a software combination of ISIS schematic capture program and ARES PCB layout program. This is an integrated development environment. Tools in this suit are very easy to use for designing the circuit. it provides features such as fully featured schematic capture, highly configurable design rules, interactive circuit simulator, extensive support for power planes, and integrated 3D viewer.

Results of Simulation Using PROTEUS Software

The schematic representation of the Telemedicine Consultation System is designed by using the Proteus software and the code is done through compiler software. Here the result is represented as two figures, 1. Normal Simulated Result(all vital parameters in normal range) , 2. Abnormal Simulated Result(ECG, SpO2, BP in abnormal range i.e represented by glowing LED). The representation is shown in following figures.

CONCLUSION

This proposed telemedicine consultation system over comes the problem of monitoring

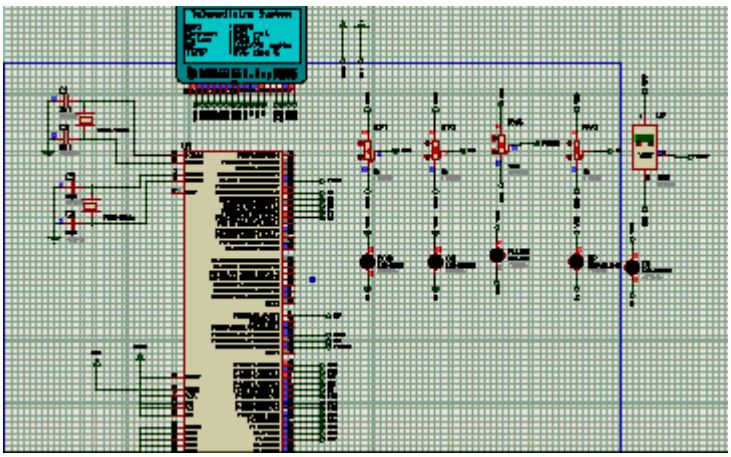

Fig. 5.1. Normal Simulated Result

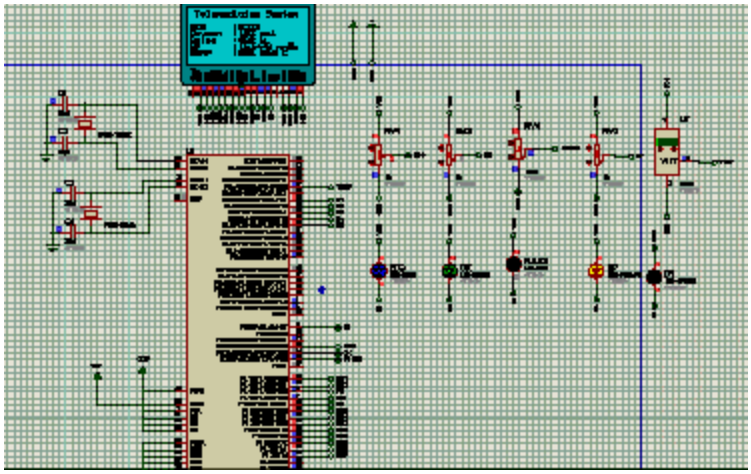

Fig. 5.2. Abnormal Simulated Result

patients at home and it is easily portable and can be reconfigured to another patient. This system monitors ECG, BP, SpO2, Temperature, and Oxygen level in cylinder , provides basis for remote diagnosis of patient and control functions for disorders.

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