MULTIPARA MONITORING AND ALERTING FOR NEONATAL INTENSIVE CARE UNITS USING ZIGBEE AND LAB-VIEW

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Abstract: **A generic real-time wireless communication system is being designed and developed for short and long term remote newborns monitoring applying wireless protocol. The Microcontroller transmits the data over the air using ZigBee transceiver in the band of 2.7 gHz. At the receiving end a microcontroller with another ZigBee transceiver is used to receive the data and it is decoded and fed to microcontroller, which is then displayed over the LCD display in real-time. If there is a dangerous change in newborns status an alarm is sounded to alert the medical staff.**

Keywords: **ZIGBEE, Infant, microcontroller, LAB-VIEW**
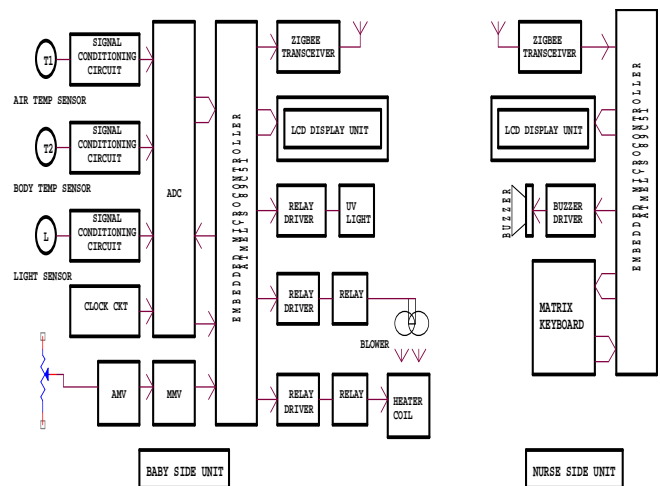
1. INTRODUCTION

The incubator is considered as an air conditioned room with special specification which we can control it with respect to the condition of baby in incubator Incubators are designed to provide an optimal environment for newborn babies with growth problems (premature baby) or with illness problems. The incubator is an isolated area environment with no dust, bacteria, and has the ability to control temperature, humidity, and oxygen to remain them in acceptable levels such as (36°C-38°C) for temperature,(70%-75%) for humidity. Newborn babies with growth problems usually have a net body area greater than normal babies from the same age. This in turn makes their heat loss greater than normal babies. Moreover, their net mass is less than the normal babies and makes them unable to keep their body temperature to the required level

2. ZIGBEE

ZigBee is a specification for a suite of high level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee is used in applications that require a low data rate, long battery life, and secure networking. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range wireless transfer of data at relatively low rates. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth or Wi-Fi.

3. MICROCONTROLLER

The microcontroller is the most important unit of this system. There are two microcontrollers in the complete system. The Transmitter uses one microcontroller and the control unit uses one more microcontroller. The microcontroller does all controlling activities of the system by executing a program stored into its memory. The microcontroller chosen for this project is ATMEL's 89C51.It is an 8-bit microcontroller with

4-K Bytes of internal flash program memory, 128-Byte Data memory and 4-I/O ports. Its instruction set is compatible with Intel's 8051 microcontroller. It is an ideal choice for compact embedded system design. The microcontroller controls all subsystems like DC motors drive circuits, limit sensors, gun firing control, relays, keypad LCD panel etc.

Analog to digital converter (ADC):
The ADC section is responsible to convert the analog signal into a binary number. When any analog signal is applied at its inputs and a command is given to start the conversion process, an ADC converts the input signal into a proportional binary value, by taking some time. When it finishes conversion and is ready with the digital data, it indicates with an end of conversion signal. The microcontroller can now read the digital data from ADC. An 8-bit, successive approximation type ADC is used.

Clock generator for ADC:
An ADC requires a clock signal for its internal operation. There is no internal clock arrangement available for ADC used in this project. Hence, an external clock generator is required. A clock generator can produce a clock signal with relatively good frequency stability. Here we are using an IC 555 timer chip to produce these clock signals at ttl level. The IC 555 is operated in astable mode to produce square wave clock signal at about 100 kHz frequency. This ttl level clock signal is applied to clock input pin of the ADC.

Heart rate simulator:
Since creating all the possible normal and abnormal conditions, on a human subject (patient) is not possible, an additional arrangement is provided in our project, to artificially produce brady-cardia and techy-cardia conditions. This system actually simulates the patient's cardiac conditions. Thus it enables us to test the performance of our instrument rigorously under various conditions of the heart rate. The patient simulator uses one astable multivibrator and one monostable multivibrator. The astable multivibrator produces continuous train of pluses at adjustable frequency rate, and the monostable multivibrator shapes these pulses into a fixed width pulse that is suitable to be read by the microcontroller. The micro-controller evaluates present heart rate, by measuring the duration between two pulses. Once the heart rate becomes abnormal, it produces a loud sound by activating the speech processor to alert the doctor or other medical staff.

Temperature sensor and signal condition circuit:
The temperature sensor chosen for this project is LM35D. It is an industry standard semiconductor transducer, suitable for the temperature range of -50°C to +150°C. It is a direct voltage o/p device. It produces 10mV/°C of surrounding temperature. This voltage is amplified to make it suitable to be sensed by the ADC and for calibration. Since the output of sensor is 10mV/°C. The resolution of the ADC is 20 mV. Hence the signal is amplified precisely twice. The signal from the sensor is fed to signal condition circuit. It is for signal amplification, conditioning and standardization. It provides the required gain to the temperature signal. It also facilitates for the calibration of the sensor output signal. This analog signal is then fed to an ADC for converting it into a binary (digital) number. Then it is provided to microcontroller for further processing.

Instrument amplifier:
It is for signal conditioning and standardization. It provides differential gain to the temperature signal. It also facilitates for the calibration of the sensor output signal.

Buzzer and drive circuit:
When any abnormality is sensed by the microcontroller through the sensors, an audio tone produced by a buzzer. The microcontroller controls the sound produced by buzzer through a drive transistor. The buzzer driver consists of a npn transistor operated in ce configuration. It supplies current to the buzzer element connected in its collector. The microcontroller sends ttl level signals, a logic '1' to turn on the buzzer and a logic '0' to turn it off.

ZigBee transceiver modules:
ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on an IEEE 802 for personal area networks. ZigBee is targeted at radio frequency (RF) applications that require a low data rate, long battery life, and secure networking. ZigBee has a defined rate of 250 kbps best suited for periodic or intermittent data or a single signal transmission from a sensor or input device. The ZigBee, also known as XBee technology allows these devices to act as routers or end devices. The firmware that resides on the microcontrollers of the ZigBee modules has the capability for the devices to operate as either. The hardware for each of these nodes is the same. The XBee RF Modem from Digi International is a wireless transceiver. The XBee uses a fully implemented protocol for data communications that provides features needed for robust network communications in a wireless sensor network (WSN). Features such as addressing, acknowledgements and retries help ensure safe delivery of data to the intended node.

The XBee also has additional features beyond data communications for use in monitoring and control of remote devices. These modules can be configured through software provided by the manufacturer. The input and output of XBee are UART. It communicates asynchronously through its serial port. It is easy to extend its network size by changing its composition into ad-hoc, star, mesh, and hybrid forms. Thus these characteristics will work useful for indoor localization. ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4 standard for Wireless Sensor Networks. ZigBee devices can be interfaced to the computer or other end devices like microcontrollers.
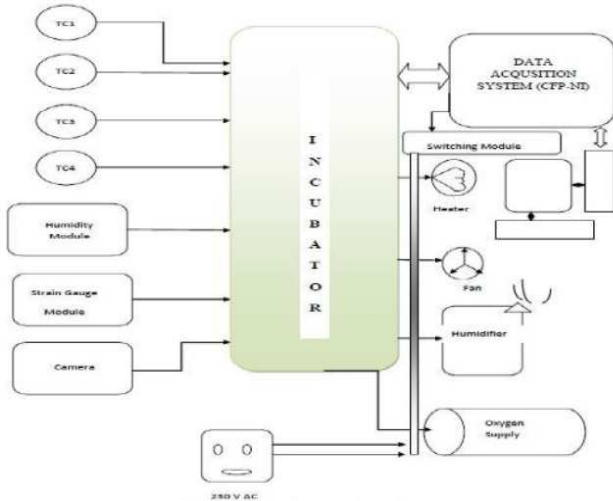
4. LAB-VIEW

Figure 2 Block Diagram Of Neonatal Incubator System

LabVIEW programs are called virtual instruments (VIs).Stress that controls equal inputs, indicators equal outputs.Each VI contains three main parts:Front Panel – How the user interacts with the VI.Block Diagram – The code that controls the program.Icon/Connector – Means of connecting a VI to other VIs. The Front Panel is used to interact with the user when the program is running. Users can control the program, change inputs, and see data updated in real time. Stress that controls are used for inputs- adjusting a slide control to set an alarm value, turning a switch on or off, or stopping a program. Indicators are used as outputs. Thermometers, lights, and other indicators indicate values from the program. These may include data, program states, and other information.Every front panel control or indicator has a corresponding terminal on the block diagram. When a VI is run, values from controls flow through the block diagram, where they are used in the functions on the diagram, and the results are passed into other functions or indicators.

4. CONCLUSION

We have proposed a low-cost solution to enhance the remote monitoring capability of existing health care system. We conducted a feasibility study of using ZigBee network based heart rate monitoring system.It is secure, robust and low-power consuming.It can operate on multiple channels so as to avoid interference with other wireless devices or equipments in the hospital.Real time parameters like temperature, Humidity, Weight, images etc can be acquired and even fault tolerant conditions can be implemented to save the life of infant. More sensors can be included to reduce noise, Vibrations etc. Remote monitoring and control of parameters is useful especially in case of transport incubators and also remote treatment of babies where proper medical facilities are not available. The cost incurred is the equipment cost and the effect is life saving one.

5. REFERENCES

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