An Infant Monitoring System and Automatic Cradle Swinging

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Abstract— In this paper, a new design is proposed to reduce the mortality rate of infants and the risk of Sudden Infant Death Syndrome (SIDS). Infants have some inborn factors such as disorder in lungs or glands, respiratory infections and improper sleeping positions which are the causes of SIDS. Some vital parameters such as CO2 and Heart rate of the infants were measured and the bassinet swings automatically when the infant's mattress gets wet. The system consists of Carbon dioxide, Heart rate and Urea Sensors along with an Automatic swinging cradle. The vital parameters were measured and displayed in the LCD. The automatic swinging cradle swings in both direction when the baby cries. This system can be proposed for multiple infants in a large nursery rooms.

Key words: Infants, SIDS, Sensors, Automatic Cradle Swinging

I. INTRODUCTION

The traditional method for monitoring an infant's vital signs requires direct supervision from hospital staff or parents. Sometimes it is difficult to identify certain physiological changes which may be of concern. This health monitoring system provides real time indication of any changes in the infant's status. We can conveniently monitor the infant's situation in the NICU or at home while they go about their daily activities. Traditional monitoring techniques are difficult to wear for long periods of time and may cause discomfort to the infant. Wireless and wearable sensors provide more convenient and long term monitoring.

Sudden Infant Death Syndrome (SIDS) is the unexplained death of an infant below the age of one year. It usually happens without any warning signs during sleep, which is why it is difficult to identify and predict. Therefore our proposed monitoring system would be an effective way to predict the onset of SIDS.

In recent years, a wide range of wearable devices and sensors including accelerometers and gyroscopes, smart fabrics and actuators, wireless communication networks and power supply and data capture technology for processing and decision support have developed for clinical research and health monitoring. Various kinds of wearable sensors have emerged for different purposes with the development of sensing technologies.

As proposed by Hsu L.C et.al continuous health status monitoring of infants is achieved with the development and fusion of wearable sensing technologies with low energy consumption microprocessor with high performance data processing algorithms.

The paper did not give the exact result of the monitoring due to wearable devices on the infant [1]. It gives discomfort and improper result when the infant crawls around with the wearable device disconnected.

Metal oxide sensors have high sensitivity due to specific interactions of gas molecules with thin metal oxide films, however, the films can also be sensitive to variation in temperature and humidity and some oxidizing and de-oxidizing gases [2]. According to Singh.S and Hsiao.H, the purpose of the paper is to evaluate the environmental effect on metal oxide nitrogen dioxide sensors quantitatively. Selection of a gas sensor requires consideration of environmental effects that can significantly affect performance and cause false alarms.

Humidity and temperature control in NO_2 sensor is effective and based on this we propose CO_2 sensor for respiration and humidity control. Inhalation of nitrogen dioxide can cause nausea and respiratory disorders.

II. STRATEGY USED

A. System Design and Overview

The system is designed in a crib surrounded with CO_2 sensors all around the crib to ensure proper monitoring of respiration. MQ135 CO_2 sensor is used, it is a metal oxide based sensor and works according to the conductivity of exposure gas. The sensitivity range for the CO_2 sensor falls around 100-1000 ppm. Heart rate sensor can also be called as the photo sensor-TCRT 1000. The photo sensor consists of a LDR, IR light emitter and photo transistor. The heart beat pulses causes a variation in the flow of blood to different regions of the body.

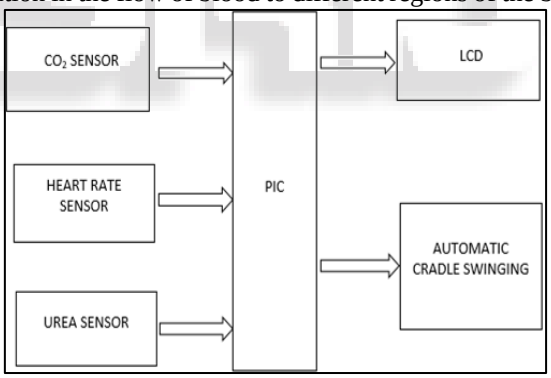

Fig 1: Block diagram of Infant Monitoring and Automatic cradle swinging system

When a tissue is eliminated with a light source it either reflects or transmits. Some of the light is absorbed by the light and is transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in the tissue. The detector output is in the form of electrical signal and is proportional to the heart beat rate.

Urea sensor is a resistive type of sensor and it senses both sodium chloride and potassium chloride component in the urine. If it senses any component from the urine, the resistance value of sensor increases and the cradle swings if the mattress gets wet.

The automatic swinging cradle consists of an ULN driver, two relays and a DC gear motor. The ULN driver is used to drive high voltage or current to the relay. ULN driver is also called as the Darlington transistor or driver since it has

inbuilt bipolar transistor. The two relays are used to switch on to the clockwise and anticlockwise direction. Solid state relays are used. If the common terminal touches the normal open the cradle swings and if it touches normal close the cradle stops swinging. The electrical signal from the relay switches the DC gear motor to rotate the shaft.

III. RESULT

Name	CO_2 Level	Heart Rate
Infant-1	174ppm	84 beats/min
Infant-2	1120ppm	142beats/min
Infant-3	3000ppm	190beats/min

Table 1: Health status of some infants

Keeping the above health status of the infants, the vital parameters are measured and monitored continuously. The cradle swings automatically when the mattress gets wet.

IV. CONCLUSION

A modern approach for an infant monitoring system using multiple sensors can be introduced. This system provides several advantages in compared to the traditional method. Apart from the sensors we have proposed, more parameters can also be integrated and each sensor can be connected to a LCD Display. A proposed system can be implemented in the nursery rooms for multiple infants.

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