DESIGN AND IMPLEMENTATION OF GSM BASED REAL
TIME NEONATAL INTENSIVE CARE MONITORING
SYSTEM FOR NEWBORN INFANTS

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PREFACE

Neonatal monitoring refers to the monitoring of vital physiological parameters of premature infants, full term infants that are critically ill. Babies that are born after a pregnancy lasting 37 weeks or less are typically considered premature. Critically ill neonates are a special group of patients that consist of premature infants who may suffer from diseases that are mainly caused by immaturity of their organs, and full term infants, who become severely ill during or immediately after birth. In particular, these premature infants can weigh as little as 500g with a size of a palm and are highly vulnerable to external disturbances. Critically ill newborn infants are normally admitted to a Neonatal Intensive Care Unit (NICU) for treatment by neonatologists and specialized nurses.

Neonatology is a subspecialty of pediatrics that started to develop in the 1940s. After the World War II the specific needs of sick newborn infants were recognized and new premature nurseries were built (Avery, 1998). The term “Neonatology” was first used by Alexander Schaffer in 1960 in the introduction of the first edition of his book (Philip, 2005; Schaffer, 1960). The miniaturization of samples for blood tests, needed for clinical management including electrolytes, bilirubin and blood gases was one of the major advances in the development of Neonatology. In the following decades important progress was achieved in thermoregulation, nutrition, growth, respiratory support, cardiopulmonary support and infection control (Philip, 2005).

Newborn babies who need intensive medical attention are often admitted into the Neonatal Intensive Care Unit (NICU). The NICU combines advanced technology and trained healthcare professionals to provide specialized care for the tiniest patients. NICUs may also have intermediate or continuing care areas for babies who are not as sick, but do need specialized nursing care. About 10% of all newborn babies require care in a NICU.
The region of present study of interest is a **GSM Based Real Time Neonatal Intensive Care Monitoring System**, which integrates the health parameters like Pulse oxygen, Pulse rate, Neonatal Infant Blood Pressure [NIBP], Temperature monitoring & Control, Phototherapy and Radiant warmer.

Most babies admitted into the NICU are premature (born before 37 weeks of pregnancy), have low birth weight (less than 2.5 Kg or 5.5 pounds), or have a medical condition that requires special care. Twins, triplets, and other multiples are often admitted to the NICU, as they tend to be born earlier and smaller than single birth babies. Babies with medical conditions such as heart problems, infections, or birth defects are also cared for in the NICU.

**Monitoring in the NICU**

In hospitals, babies in the NICU are monitored with the infrared monitor on the extremities for measuring oxygen saturation in the blood and heart rate, using ECG electrodes only in the most critical situations. The time for monitoring varies and depends on the patient’s condition: some babies may be monitored for one day or two, some may require continuous monitoring for weeks or even months. The block diagram of the GSM Based Real time Neonatal Intensive Care Monitoring System is shown in the figure1. Which ensures Neonatal data confidentiality at all time. The various aspects of study are consolidated into a thesis total of seven chapters.

In Chapter 1 a brief review on **Neonatal Health Monitoring System**, which is used to take care for Newborn Infants and their uses and advantages are presented. The earlier literature on the **Neonatal Intensive Care Monitoring System** is also presented in this Chapter

The chapter 2 covers a detailed description of the Integrated **GSM Based Neonatal Intensive Care Monitoring System** with their micro module, components, architecture and fabrication. The presentation covers the GSM, Processing Unit, Touch Screen with the help of internal structure. These Processing Unit is integrated the
parameters which is acquired from various sensors like temperature, SPO$_2$, NIBP, Phototherapy and Pulse rate.

Chapter 3 deals with the designing of **Body temperature of Infant** is monitored with adhesive thermistors and **Radiant warmers**: Radiant warmers are used when a baby is very unstable or extremely premature. Small babies have a large surface area compared to their volume, and little body fat, and cannot maintain their own temperature. The overhead arm contains electric heating elements that are directed down toward the infant. A thermostat is hooked up to a sensor on the baby's abdomen and adjusts the power of the warmer up and down dynamically so that it delivers whatever heat is necessary to keep the baby at the desired normal temperature. The open nature of the radiant warmer allows physicians and nurses to have easy access to the baby from all sides during the most critical periods.

The Chapter 4 deals with the development of a Non-Invasive Optical Plethysmography or Pulseoxymeter. The Pulseoxymeter is used for the measurement of the Blood Oxygenation of a patient. It demonstrates the implementation of a Single-Chip portable Pulseoxymeter using the ultra low power capability of the Processing Unit. In Pulseoxymeter, the calculation of the level of the oxygenation of blood (SaO2) is based on measuring the intensity of light that has been attenuated by body tissue. The pulseoxymeter having a sensor probe, the Pulseoxy Probe having two LED lights sources of Visible/RED LED and Infrared Led, and a photo diode detector. The detector signal are measured and amplified by the inbuilt operational amplifiers, analog to digital converters, and digital to analog converters to measure the Pulse Oxygen. The measured pulse oxygen, heart rate are displayed on the liquid crystal display and simultaneously the measured values are transferred through GSM and to the data base for the further analysis.

The chapter 5 deals with the Phototherapy unit used when babies are jaundiced (yellow). Some degree of jaundice, which is caused by the presence of a molecule called bilirubin in the blood, is common and even normal in newborns. However, in sick infants, jaundice can result from a variety of problems, and when jaundice is extreme it can cause
brain damage. Certain wavelengths of light (in the blue part of the spectrum) can cause a chemical reaction that converts bilirubin into a harmless form as blood passes through the skin.

The chapter 6 deals with Neonatal Infant Blood Pressure (NIBP) data reported for premature and term newborn infants after 24 hours of age. To determine BP levels and BP trends in a representative population of infants admitted to neonatal intensive care units (NICUs). The requirements for successful blood pressure monitoring are that the method should be easy to setup, reliable, and give continuous information or enable measurements to be made at frequent intervals with minimal disturbance to the baby.

The chapter 7 deals with results, discussion and suggestions for the future development of these kind of systems with the advanced features that enhances the concerns regarding the protection of newborn infants health information and privacy to save them to give new life by implementing new advanced technologies to furnish the information to concerned doctors and nursing staff.

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