

Reliable Infant Warmer to Avoid Accidental Overheating of Newborn

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Abstract- Hypothermia at birth is one of the most important risk factors for newborn baby, As per WHO more than 60% newborn babies suffers from Hypothermia . To avoid risk of Hypothermia most of the doctors use infant warmer or incubator to mentioning temperature i.e. 36.5 °C. As per literature survey in existing system one of the key challenges is overheating of warmer as the sensor moves away from the body of infant. Most warmers commonly use only one sensor that is Skin sensor, if this sensor goes away from body as well as from bed area then warmer goes overheating. So we require second sensor and that should be fixed on bed area. [1]

First stage is to develop a system that will continuously observe and Control the two side temperature that is Skin & Air Sensor.

Second Stage avoid Over Heating Problem, If ‘bed temperature’ or ‘baby temperature’ goes up to 38°C, So heater should not be ON to radiate heat energy above 38 °C.[5]

With the help of proposed system it is possible to overcome the ‘Overheating’ problem by using Two Sensors i.e. Skin Sensor & Air Sensor.

Keywords – World Health Organization (WHO), Hypothermia

I. INTRODUCTION

When baby temperature goes below 32°C then baby can have cold stress, also called Hypothermia. When the baby suffers from Hypothermia, a specific range temperature must be maintained to overcome Hypothermia. If baby does not get proper temperature then baby may suffer and lead to serious condition. WHO study in Ethiopia revealed that

infants born outside the hospital have 67% of high-risk for hypothermic.[1]

Treatment of Hypothermia

There are number of treatment for hypothermia but most of the doctors are using infant Warmer and Incubator. Generally for the low birth infant doctor prefers Incubator, otherwise globally doctors’ preference is warmer. [1]

Radiant Heat Warmer / Intensive Care Warmer

The concept of head radiation is used in infant warmer, where the baby is placed on biocompatible bed and an overhead heater delivers radiant heat through open air environment from a specific distance on infant. A temperature sensor probe is used to monitor infant temperature which is used to control the Heat radiation. Radiation of heat can be controlled either manually or with servo mode. [2]

As Per WHO 400W heater is required and this must be placed 70 cm above the infant. Radiant warmer which is automatically controlled by using patient probe which is a temperature sensor attached to the skin. The automatic system turns ON the heat supply when the infant's heat sensor indicates a lower temperature than the desired temperature and turns it OFF when the infant's temperature reaches the maximum SET point. [1]

II. METHODOLOGY

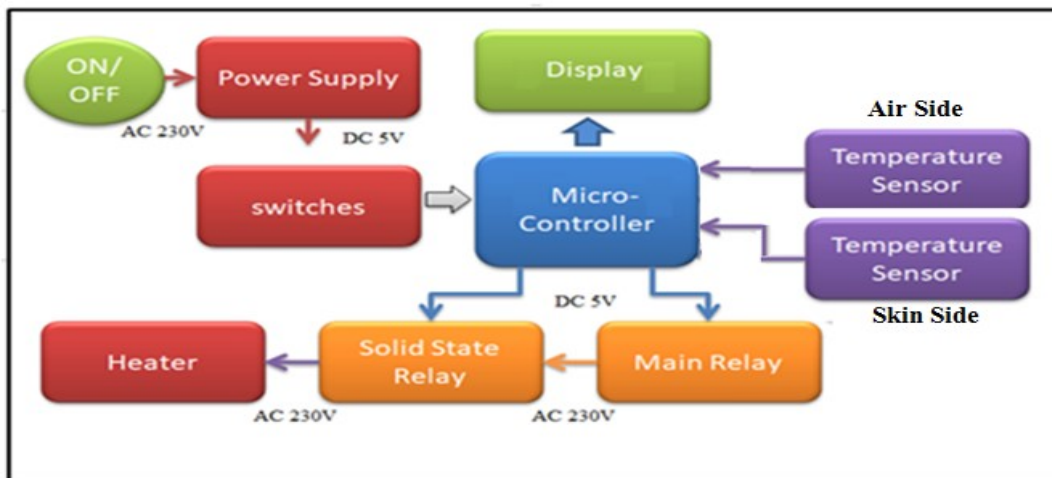


Fig 1: System Architecture

There are three parts in Warmer system:

1. Heater
2. Controller
3. Sensor

1] Heater – In warmer Heater is the most important component which is a source for generation of heat. There are variety of heaters available in market but selection of heater is done according to the parameters mentioned below:

- Material Type - Which type of material is used for heater.
- Temperature - The amount of heat generated by heater

- Wattage – Wattage of heater decides the range of temperature

As per literature survey Ceramic Heater is more reliable and suitable for Warmers. In this project 400 Watt heater which can radiate up to 38°C to bed which is 70cm away from the heater, [3]

2] Control Panel – Controller sense the data from the sensors and data is saved from time to time. Depending upon the sensed temperature and set value of temperature range, controller switches the heater to ON or OFF.

III.SYSTEM FLOWCHAR

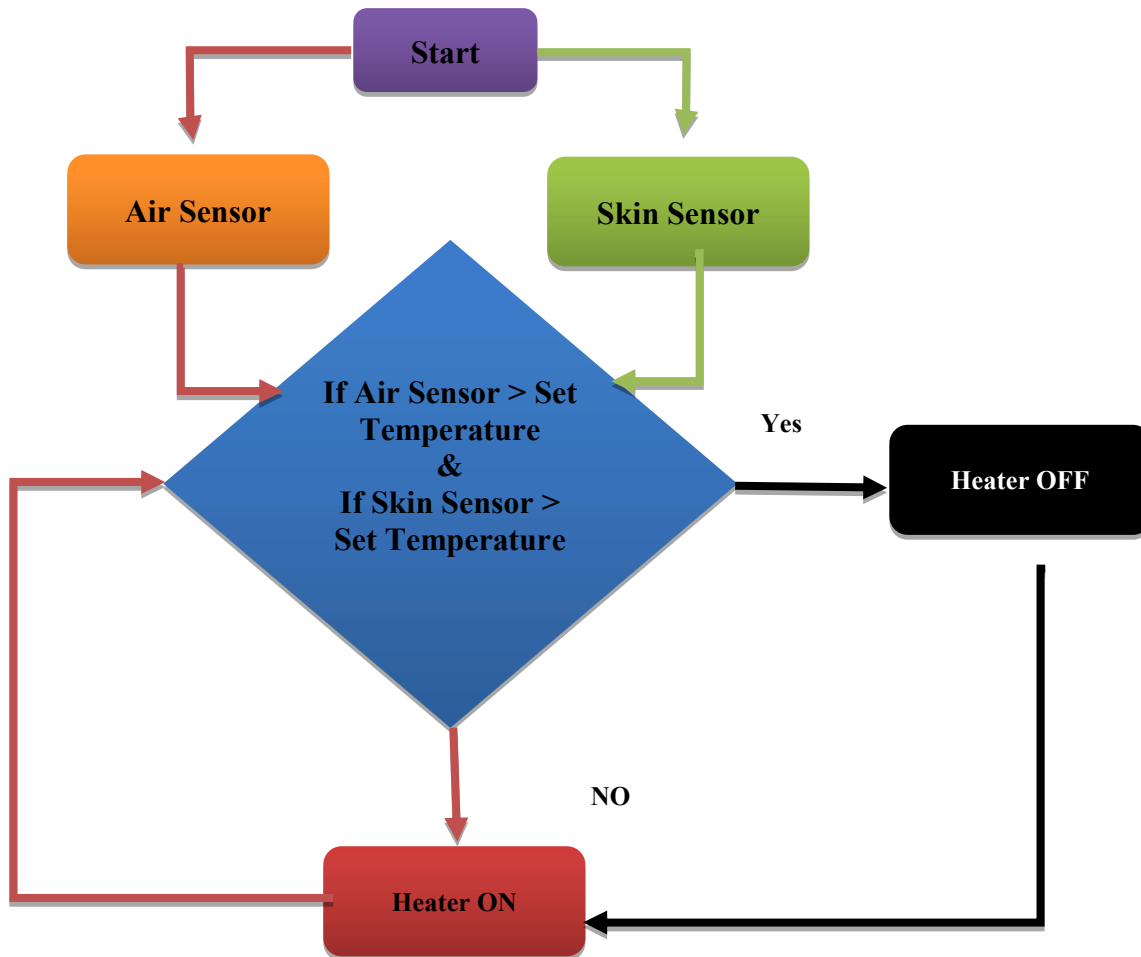


Fig 2:-System Flowchart

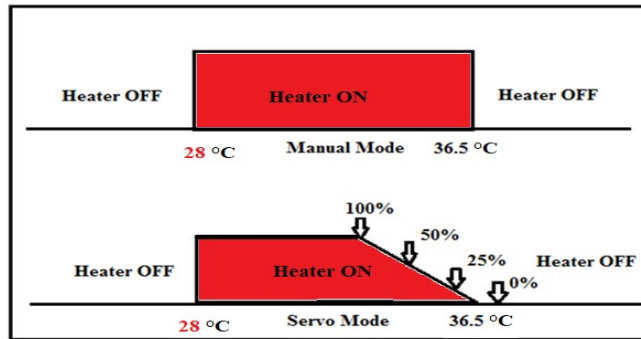


Fig 3:- Difference between Manual and Servo Modes

Most of Radiant Warmers having two modes: a) Manual mode
b) Servo mode (automatic mode).

Manual Mode: In manual mode the heater will be off once it reaches to the set value, prior to set value there is no regulation on the heater. Heater will be ON keep on radiating heat till the set value.

Servo Mode: In servo mode before reaching to the set value, heater will start reducing the heat radiations gradually and finally at the set value, heater will be turned OFF. This system is more reliable when compared to manual mode.[6]

For our project ATmega328 is used which is made to operate in servo mode. ATmega328 operates in low power and is faster than other regular controllers.[4]

3] Sensor

Selection of sensor is done according to the following parameters:

1. Stability
2. Long Life
3. Linearity

4. Inbuilt data conversion

In this project Thermistor K10 temperature sensor is used as it is more stable and linear.

According to literature survey one of the key challenges is overheating of warmer due to detachment of sensor from body of infant.

Avoidance of the problem for overheating in Existing system

- First stage is to develop a system that will continuously observe the temperature sensor as it moves away from the body of infant.
- Second stage is that if skin sensor is detached from the body then second sensor i.e. ‘Air sensor’ should be used to take the necessary action.
- Generally the Air sensor is kept on the bed which may cause overheating. So, a proper way to fix the Air sensor is needed such that its data is properly received by the controller. In this project as shown in figure 4 air sensor is fixed on the edge of the bed so that it continuously gives the proper reading to controller in consultation with doctor.



Fig 4:- Two sensors have practically fixed on bed and skin

V. RESULT AND DISCUSSION

As per heat irradiance pattern shown in figure 5, it can be shown that more heat is radiated at the center of bed. Generally the infant is kept at the center, So it receives maximum heat as show in the heat irradiance pattern. Air

sensor is kept beside the infant on baby which shows 1°C to 5°C less than the skin sensor as shown in figure 6 and figure 7. So while setting the threshold value for air sensor it must be set with the difference of 1°C to 5°C in comparison with skin sensor.

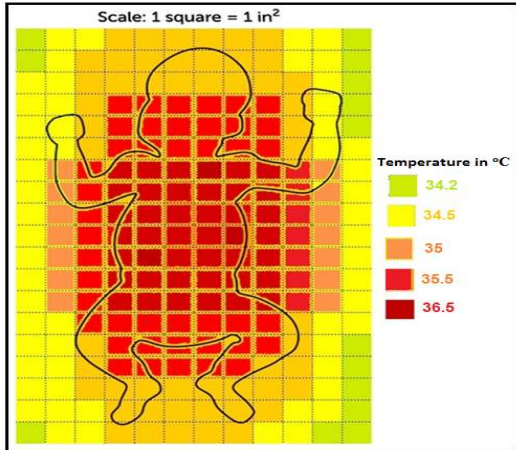


Fig 5 : Irradiance Patten of Warmer Bed



Fig 6:-Warmer Controller

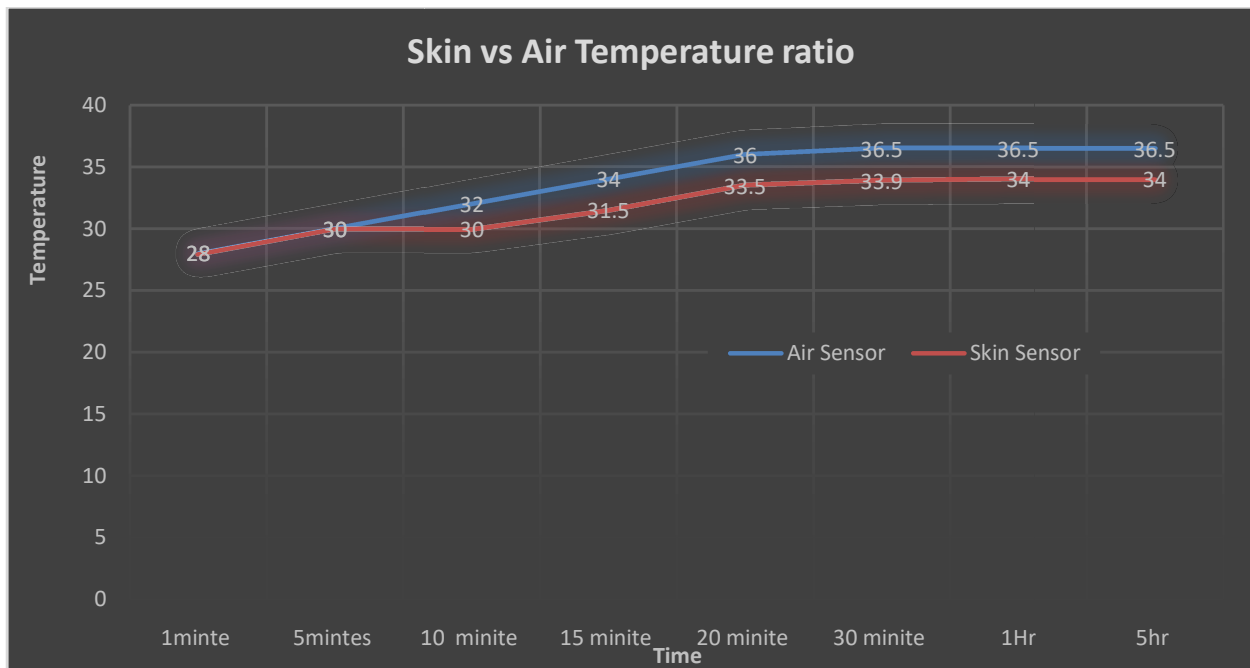


Fig 7:- Skin and Air sensor temperature ratio with respect to time

VI.CONCLUSION & FUTURE SCOPE

With the help of proposed system it is possible to treat hypothermia by using Two Sensors i.e. Skin Sensor & Air Sensor. If Skin and Air Sensor are properly aligned then the problem of overheating can be solved. In this system proper solution to overheating of warmer is provided and this system is more reliable than existing systems. This system can be modified for low power consumption and more reliability

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