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Intelligent Baby Incubator Using Solar

Rutuja G. Shelke[1], Dipali S. Sarode[2,] Shital K. Mathpati[3]
[1,2,3] *Assistant Professor Electronics and Communication Department Deogiri Institute of Engineering and Management Studies Aurangabad Maharashtra, India, Dr. Babasaheb Ambedkar Marathwada University*

Abstract: ***As there is tremendous growth in the death of new born babies preterm birth is attributing, either directly or indirectly, to at least 30% of neonatal deaths, and due to low birth weight (lbw) new-borns are facing at the risk. Out of total, or 1.8 million babies each year, die for lack of a consistent heat as they have the body fat and metabolic rate to stay warm. In such a cases there is necessity of developing an environment which is healthy to new born babies which suits to their body temperature.***

This paper is going to help to prevent the death of such new born babies. The microcontroller based baby incubator which is based on energy generated by using solar will helps to all people to prevent their baby's life from harmful environment. The cost this system is very less as compared to the other baby incubators which are used in superspeciality hospitals. So, everyone who belongs to economical backward class those who are not able to afford the cost of hospitals can also take the benefit of this system. This work proposed in this system not only used for monitoring and controlling the temperature but also provide number of advantages such as controlling temperatue, weight of the infants who is under observation , etc.

Keywords: iincubator , lbw, microcontroller, solar.

I. INTRODUCTION

Thermoregulation is a critical physiological function that is closely associated with the baby's survival. Extremely low birth weight baby have inefficient thermoregulation due to immaturity, baby may exhibit cold body temp after birth and during their first 12 hours of life. Thermo-regulation plays a unique and crucial role in the nurturing and development of baby. The temp inside the mother's womb is 38 degree (100.4 F). The thermal protection of newborn baby is very important as it plays vital role in maintaining the health of the baby after leaving the warmth of the womb at the time of birth. The wet new born finds itself in much colder environment and immediately starts losing heat as the heat loss can occur in infants with extremely low birth weight in following ways:

Conduction: The transfer of energy from the molecules of a baby to the molecules of a solid object in contact with the body, resulting in heat loss. Heat loss to cool the surrounding air.

Convection: The similar loss of thermal energy to an adjacent gas due to the heat loss to certain objects which are in direct physical contact.

Evaporation: Evaporative is the total heat transfer by energy carrying water molecules from the skin and respiratory tract to the drier environment and also the heat loss in the infants due to water evaporation from both the skin and respiratory tracts.

Radiation: Radiant loss is the net rate of heat loss from the body to environmental surfaces not in contact with body. A sustainable artificial environment is required to allow the neonate until its organs are fully matured to provide independent support to withstand the tougher outside climate. So, neonatal incubation calls for controlled warming for new-born babies. Many regions are deprived of continuous supply of electrical energy in various countries. In some parts electricity is available only for a few hours and at night. the modern incubator, suitable for single new-born may not be affordable due to high cost and lack of skilled man-power to maintain.

Thus, solar thermal energy can be used as an alternate source for keeping neonates warm especially in tropical countries. Solar energy could be used as an alternate energy source for keeping neonates warm especially in tropical countries. The present study investigated the efficacy of solar powered room heating system in the referral center for neonatal care.infants between 1750-2250 g were observed to require a mean room temperature of 32.5° c to maintain normothermia in 85 infants less than 1500 g, of the 5050 infant temperature records, only 3% showed a record less than 36°c.Solar powered room heating is effective in maintaining infant temperature and is cost-effective as compared to the existing warming device.

II. LITERATURE SURVEY

A. Nageswara Rao and G. Satyanarayana [1]

(August 2015) proposed in their work that their system, Solar energy system can utilized very efficiently to minimize the neonatal deaths in developing countries like India and that to remote areas where conventional power is unavailable. Their system is with low cost and is when compared to that of conventional incubators. The system can be maintained with locally available skill persons. Their future work was directed towards the design of components for solar energy systems suitable to remote areas having shortage of conventional power. But as it is essential to provide an enabling environment (particularly temperature control) for premature born babies to minimize the neonatal deaths. In their work they proposed the solar thermal energy can be utilized to keep neonates warm. Their system presented the design of solar thermal incubator system for accommodating five babies, which was successfully tested in a leading hospital in Mumbai, India[1].

B. H.Joshi and D.Shinde [2]

(*February 2015****),*** *they have proposed a system which is helpful to designe a model which was effectively used in rural* areas. Their equipment can be effectively used by technicians in a small health care centre and a life saving machine for low birth weight infants as the components in their model were easily fixed. Their chamber was also sufficient enough to accommodate the baby comfortably. As the electronic part is separated from the Baby's compartment the assurity of life of that baby is guareenteed. Their system was very simple and efficient in maintaining the temperature of the chamber irrespective of the outside temperature with very low cost[2]. In their system, thay developed a model which not only monitors and controlls the temperature but also provide number of advantages such as controlling temperature, weight, etc. There are various authors who develoed a model of incubator and as per the survey which we have referred there are four million babies worldwide who die in the first month of life, one million die on their first day and the preterm birth is attributed, either directly or indirectly, to at least 25% of neonatal deaths, & low birth weight (LBW) new-borns are at the greatest risk. About half of the worldwide total, or 1.8 million babies each year, die for lack of a consistent heat until they have the body fat and metabolic rate to stay warm[3]. In the system presented by Eric Geise and Nasser H Kashou[3] in the year 2014, a portable solar powered infant incubator presents a solution of two major issues of the target environment and developing countries are high infant mortality and unreliable grid power. Their work has allowed the incubator to be a sustainable device in rural areas and in project the user is protected by the placement of heaters away from the incubator doors and the use of protection grid over the heater fans. The design achieves this by the use of inexpensive materials found in developed nations [7]. According to system presented by S.R .Daga and D.Sequera [4] in the year 2013, Eighty five babies weighing less than 1500 g at birth were managed in the solar incubator room. At any given time, there were 3-4 babies in the room. Out of 5050 rectal temperature readings, 4383 (86.8%) Were more than 36.5°C, 515 (10.2%) between 36 and 36.5°C and 152 (3%) were less than 36" C ($p < 0.0001$). During the three years in use, the system has functioned without any significant breakdown and has been capable of maintaining rectal temperature above 36.5°C in a significantly large proportions of babies[7].

C. Adhi Ksatria Theopaga, Achmad Rizal and Erwin Susanto[5]

in the year 2014, implemented a PID control to a Baby incubator with some specifications such as set Point is set to 320 C, using atmega328 in Arduino UNO R3 board, power maximum of the heater is 250 W and reference temperature is the temperature Read from a temperature sensor SHT11.The purpose of their research was to design a baby Incubator system with the capability of monitoring and controlling its temperature effectively using PID control. Their work was having the disadvantage of the transient Response time of the position of living long enough from the off position or conversely, and requires a large enough power to turn on and turn off the Heater continuously. To overcome the drawback of their system, we need a method to control the temperature in order to further conserve power.[9]In their work they analyzed and design of PID based Baby incubator is presented. The design is proposed to replace the conventional on off baby incubator to convenient purpose. Based on the experimental tests, the system is performing well. The Arduino Uno is a microcontroller board Based on the atmega328. Arduino UNO has 14 Pins input/digital output (6 pins can be used as PWM outputs), 6 analog input pins, 16 mhz Ceramic resonator, a USB connection, a power jack, An ICSP header, and a reset button[10].

D. Hitu Bansal1, Dr. Lini Mathew and Ashish Gupta [6]

in the year 2015, developed an equipment which can be effectively used by technicians in a small health care centre and can be a lifesaving machine for low birth weight infants. The components can be easily fixed. The chamber is sufficient enough to accommodate the baby comfortably. As the electronic part is separated from the Baby's compartment baby can be assured safe. The temperature of the system can be understood. This system was simple and efficient in maintaining the temperature of the chamber

irrespective of the outside temperature and is designed at a low cost. In that system various sensors and then various components are used such as temperature sensor, pressure sensor,humidity sensor, LCD, cooling fan, 4 relay boards, SIM SMS MODEM to monitoring the baby incubators.This system helps to prevent the death of such babies. The microcontroller based baby incubator helps to all people. [13].

E. N. A. A. Hadi, M.H.C Hasan, N.M.Z.Hashim [7]

(June 2015) proposed a system in which they used Arduino UNO as a micro-controller and the RF transmitter and receiver module were implemented and sends the data from micro-controller to the computer for better monitoring purpose.Suitable temperature is a vital element of the human being and even for machines in the industry. Their work was aimed to explore the implementation of radio frequency in the certain field. The radio frequency was implemented in the NICU for the incubator system. The concept of incubator has been identified and the function of the main component has been analyzed. The use of Arduino UNO and Arduino Pro Mini was in order to provide the portable RF monitoring device along with the enhancement of the use of wireless sensor network technology. As to control and stabilize the temperature inside operation theatre, LM 35 has been placed inside the operation theatre that will perform as temperature sensor. It gives a signal to PIC16F876A to trigger the blower or heater. The temperature needs to be maintained degree to 22 degree. A prototype of radio frequency monitoring device was designed and operated successfully. The readings of temperature and humidity were able to be displayed. They finally proposed a prototype of radio frequency monitoring device which was done successfully. The readings of temperature and humidity were able to display. The result obtained in their system achieved the first objectives of this system.[15] The development of circuit for transmitter and receiver using Arduino microcontroller was intend to achieve the second objectives .

F. Prof. Kranti Dive, Prof. Gitanjali Kulkarni [8]

(November 2013) they proposed a system in which they have designed an embedded device which includes sensors for Door Security, Light Intensity, Voice detection of incubator for the continuous monitoring of infants under clinical and home conditions for incubator for the monitoring of infants. The device would involve DSPIC Processor DM330011 and sensors which can be interfaced with processor. The system will monitor the 3 parameters Door, Light, Audio/ voice of the baby that he/she is ok or crying. The Door parameter provides an Intruder bell it will gives alarm/Led indication if any person will come at the place /Room of baby by breaking the sensor. Light Intensity can be monitored by using LDR (Light dependent register). All these parameters are continuously monitored by system & will display the status on LEDs or gives alarm.

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III. SYSTEM DEVELOPMENT

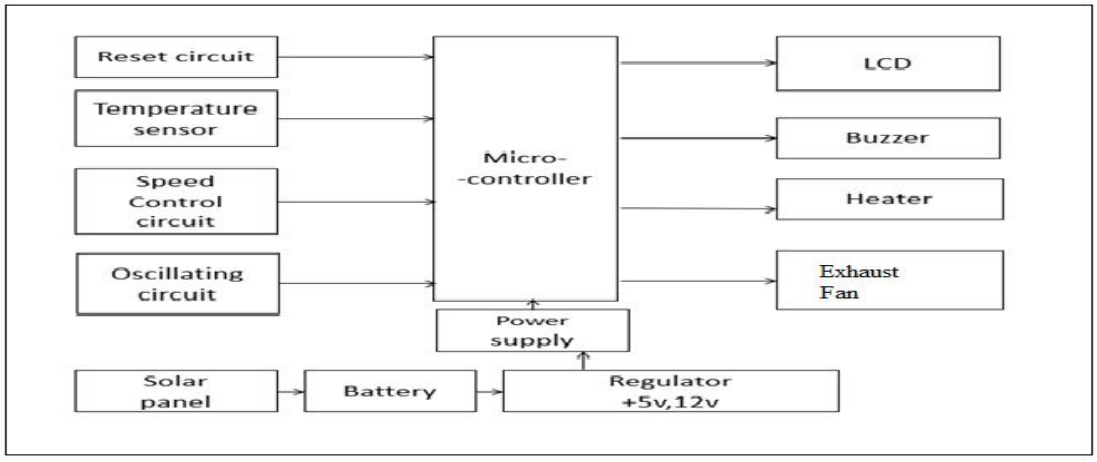

Fig. Block Diagram

As thermoregulation is very important issue now a days so there is need to regulate that temperature of the new born babies. The temperature inside the mother's Womb is 38ºc (100.4ºf). Leaving the warmth of the Womb at birth, the wet new born finds itself in a much Colder environment and immediately starts losing heat. If Heat loss is not prevented and is allowed to continue, the Baby will develop hypothermia and is at increased risk of Developing health problems and of death.. Temperature sensor is sensing the data from the incubator [5]. An incubator is an apparatus used to maintain environmental conditions suitable for a neonate (newborn baby). It is used in preterm or for some ill full-term babies. The mattress where the baby lies is completely enclosed by a clear plastic canopy. In this temperature and humidity are the parameters which have to be controlled .The temperature in the incubator is increased by a heater element below the mattress. A motor driven fan near the heater draws in fresh air through a filter and blows it past the heater, warming the air. The air is directed up through slots into the area above the mattress and circulated around. A threshold value for temperature and humidity is set manually by using the potentiometer[3]. The air temperature is monitored by temperature sensors and is adjusted by controlling the current to the heater. The user can set the incubator to control the temperature of the air. If the temperature of the incubator increased above the threshold value then the alarm will beep and the fan will be on and it remains on till the temperature decreased to the threshold value. If the temperature of the incubator decreased below the threshold value then also the alarm will beep and now the bulb will be on and it remains on till the temperature increased to the threshold value. Supplementary oxygen can be taken in by an oxygen inlet connection where it is mixed with the fresh air through the filter. By taking the water bath humidity can be increased or by dripping water on a heated element. Light bulbs heat air in the bottom part of the incubator. The air passes over a container with evaporating water, so that its humidity increases. The warm, humid air then flows upwards into the baby compartment. The baby is cared for through special access doors called arm ports. If the temperature increases above the threshold level then Fan will ON and maintain the temperature of the device& if temperature decreases below the threshold value then the Bulb will be switched on to create the heat and again the temperature will reached to the threshold value. Threshold will be set manually by using potentiometer. If the temperature falls below the set value appropriate amount of heat energy needs to be supplied in the incubator to maintain the temperature at that level. This can be done by a simple turn ON and OFF control system which will turn ON the heater when the temperature is below the set level and turn OFF otherwise.

IV. CONCLUSION

The work proposed in our system is especially helpful for rural areas for low birth weight infants. The components can be easily fixed. The chamber is sufficient enough to accommodate the baby comfortably. As the electronic part is separated from the Baby's compartment baby can be assured safe. Solar energy system can utilized very efficiently to minimize the neonatal deaths in developing countries like India and those remote areas where conventional power is unavailable. The cost of the system will be substantially low when compared to that of conventional incubators. Future work is directed towards the design of components for solar energy systems suitable to remote areas having storage of conventional power. This system is simple and efficient in maintaining the temperature of the chamber irrespective of the outside temperature and is designed at a low cost.

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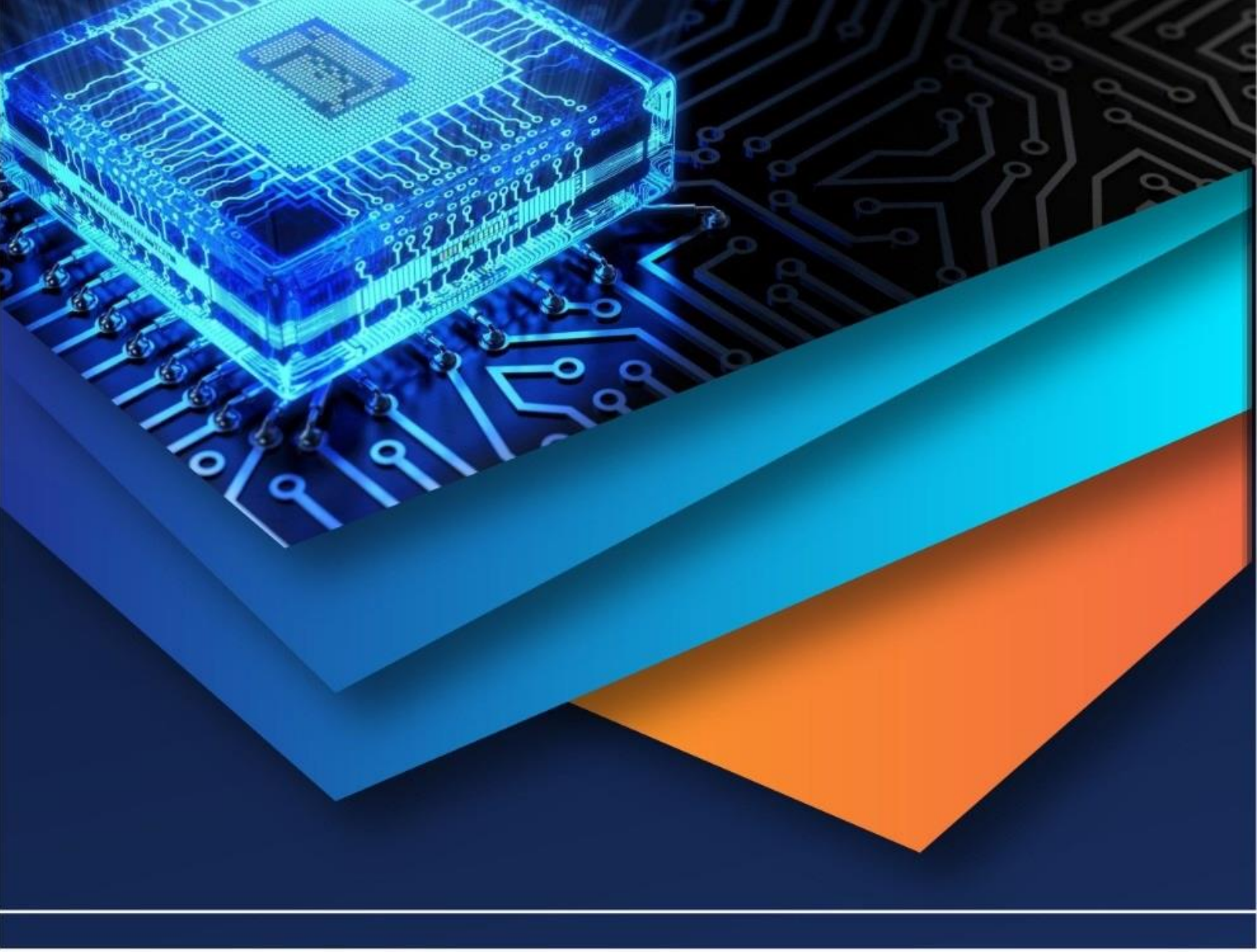

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