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Survey on Digital Age- Smarter Cradle System for Enhanced Parenting

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Abstract

This paper showcases the current published knowledge about smart cradle systems. The conventional methods in which the usage of expensive baby caring devices could be reduced and all such features can be embedded in a single baby cradle without physical attention are summarized. The basic ideas of constructing the automatic baby cradle is surveyed .The achievements of the frontier research in this particular field are described .Baby cradle is an appliance which is used to carry a baby and oscillate it automatically with certain speed for comfort to make sure the baby experiences a sound sleep. One of the methods also includes the detection of wetness in the baby bed. This wet condition of the baby is also notified to the parent through an Android application. Automatic detection of the baby's cry through a microphone to play an euphony to calm the baby .Exclusive videos of the baby movements are being captured and recorded , saved through cloud computing. Additional parameters such as the baby's temperature are known to know about the baby's respiratory conditions as well as the atmospheric temperature are measured to know about the oxygen content. The baby's weight is also being known on a regular basis. It is expected that future research in this digital age should identify subject areas when more advanced intelligent systems could be applied than it is currently evident.

Keywords: Baby cradle, Oscillating, Sensors, Detection, Temperature, Voice player

INTRODUCTION

Recent developments have been made mainly to produce a further enhanced once and to reduce its cost. In this field of "Infant Care" several advancements have been made which is mainly due to the advancements made in the development of micro-controllers.

Importance of cradle system is that several features have been embedded in single baby care unit. It automatically rocks when the baby cries, leaves the alert message to the parent indicating the diaper wet conditions. The temperature of the baby and the environment is constantly being surveyed and reported to the parents. It provides a comforting and pleasant atmosphere for the baby and ensures a sound sleep. By these advancements made in the cradle system, the parent's are not expected to put their 100% care on their baby. They can have their own space and time for their individual work. The baby cradle is broadly includes three major features such as automatic rocking, wet detection and temperature conditions

TYPES OF BABY CRADLE SYSTEM

This paper would portray the use of the baby cradles of the present generation which minimizes the works of the parents who work all day and find it difficult to manage or schedule their time accordingly.

In the present technological world few bigger steps are to be taken in order to change with accordance to the living. This answers the usage of sensors, webcams and a separate Android application for the complete caring of their baby from anywhere. This Android application is used to keep the parent updated and alert the parent if necessary. There are many task and sacrifices which all parents have to experience during a time when a child is newborn. Mom can't do stuffs for herself as she is bound to take care of the baby as the baby requires full attention. For example, she can't take a long shower, cook food properly or even have a peaceful sleep. During night this is even more tedious, each time the baby wakes up parents have to sooth the baby back to sleep. It is very difficult to monitor baby continuously especially body temperature. The baby may also be disturbed due to urine wetness of the bed so through the E-Baby Cradle that is designed it would be of best help parents at home and nurses in infants care. This will help the women to take care of the baby effectively and without effort and managing the other things at home.

HAPPY BABY HAPPY PARENT

FEATURES IN THE BABY CRADLE SYSTEM

E-Baby Cradle will swings automatically when baby cries, for this it has a cry analyzing system which detects the baby cry voice and accordingly the cradle swings till the baby stops crying. The speed of the cradle can be controlled as per the user need. The system has inbuilt alarm that indicates two conditions – first when the mattress is wet, which is an important parameter to keep the baby in hygienic condition, second when baby does not stop crying with in a stipulated time, which intimated that baby needs attention. This system helps parents and nurses to take care of babies without physical attention

The following listed are the various methods for the enhancement of the baby cradle. The methodologies involved are of features involving

1. Automatic Rocking of the Baby Cradle
2. Wet Detection in Baby Cradle System
3. Temperature in Baby Cradle System

Automatic Rocking of the Baby Cradle

Prajapati Mitesh [6] developed a baby cradle system which basically focuses on the oscillation of the cradle. It overcomes the problem of using a D.C motor since it starts with a jerk and produces unwanted noise. His paper basically defines the speed and the force with which a automatic cradle should work. It proposes the correct mechanism using which the pendulum should operate.

Alpha Elizabeth John[1] has developed a system is divided into mainly two sections – Cradle module and Angel Care Handy Receiver which functions with PIC16F877A micro-controller which senses when the baby cries and the motor driver circuit which would gently swing the cradle. Yang Hu [25] suggested an algorithm for adjusting the cradle swaying extent by the sensor signals. The cradle is made up of an adaptive swaying device and other sensors network. While baby is crying, the sensors network can judge the reason according to detecting parameters, giving the different signals to control circuit.

Lejin P Reji ,Marie R. Harper, La Mirada Maxine R. Blea, Norwalk et al. [2] conducted a work on a baby crib or cradle adapted to be rocked automatically by an oscillatory action motor having the same effect as would be achieved by a mother rocking a crib containing an infant. Nitin Bhatnagar [7] developed a system which takes the crying sound of the baby as the input and produces the amplified sound . It is then converted to a digital signal after which the sound is compared and when its high then the cradle begins to rock. It detects the decibels in the baby's cry and starts to rock. In all the above methods the cradle would be oscillating without any control this was overcome by [3] R. Dinesh by new automated oscillating cradle focuses to swings automatically when baby cries and the DC motor is used to oscillate the cradle. The speed of the cradle can be controlled by the belt system. The C-channel uses to converts the circular motion into linear motion. It has a sound sensor system which detects the baby cry sound and accordingly the cradle swings

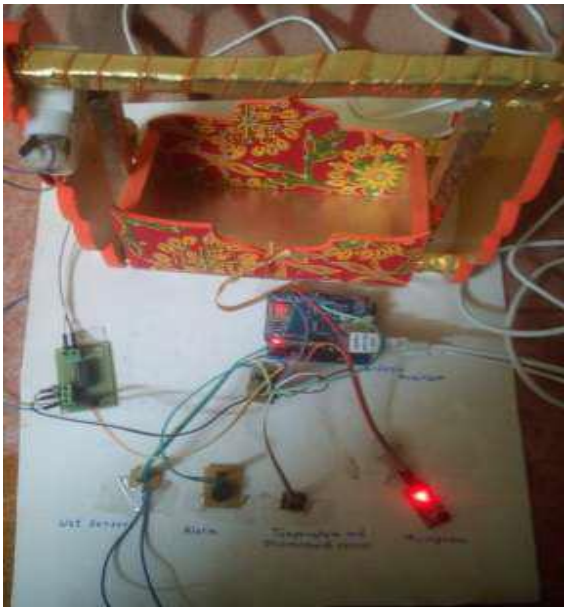

Figure 1. Automatic Rotation based cradle system

Misha Goyal and Dilip kumar [8] has calculated the maximum sound the baby has to produce for the cradle to start working. Their system calculates the sound level by, l = 20log Baby Rock Inc [10] is an innovation company which has developed a cradle with a stepper motor. There are different types of stepper motors that can provide different torque based on requirement. The stepper motor can provide accurate control, such as the degree of rotation and rotation speed. Therefore, It helps in the smooth motion of the cradle.

Rachana Palaskar [22] DC motor can offer movement motion according to its rated power. The shaft of DC motor is connected to main shaft on that the free wheel is mounted. The curve plate mounted below figure1.The bassinet is formed in contact with the free wheel by means that of rubber lining as a friction material. As per microcontroller programming the motor rotates in right-handed direction for three seconds and then in anticlockwise direction for three second. When the motor rotates in dextrorotatory direction it pushes the bassinet because the free wheel mounted on shaft is in touch with the semicircular strip underneath the bassinet and after three second the motor can rotate in anticlockwise direction and as a result of this the bassinet are pushed on the either aspect and in this manner the system can keep operating.

Rachanapalaskar1, [4] has proposed a method which would also oscillate the cradle based on the cry intensity of the baby and through cloud computing. The child voice is sensed through the sensor and through cloud computing techniques the message is send to the parent and the cradle is being rocked by clicking on the ON button in the web page. Prof. A.D. Anjikar [9] has used a different and an interesting mechanism called Slider- Crank Mechanism for the oscillation of the cradle. The++ Slider-crank mechanism is used to transform rotational motion into translational motion by means of a rotating driving beam, a connection rod and a sliding body. The sliding mass is not allowed to rotate and three revolute joints are used to connect the bodies. It converts circular motion of the crank into linear motion of the slider which makes it easy for rocking [5].

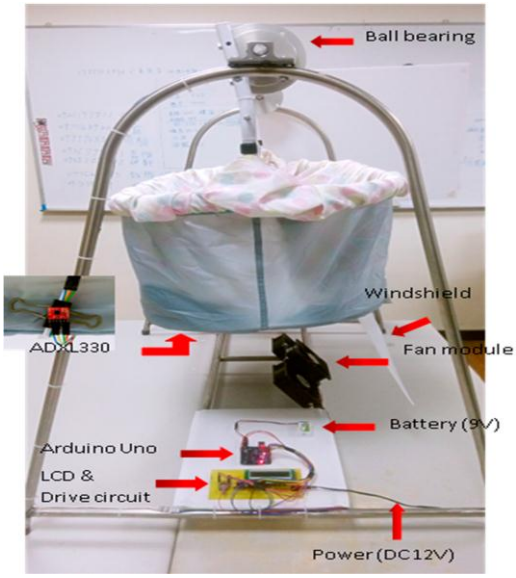

Figure 2. Automatic Rocking Based cradle

In previous academic research, hardware realization and real-time analysis is not considered but in this paper the fundamental frequency analysis is adopted to recognize a baby's hunger and pain cries in real-time. Previous research data has shown no significant difference in fundamental frequency due to the sex or age of an infant. A nonlinear operator of fundamental frequency analysis is proposed, which is expected to provide a simple yet effective implementation for infant cries recognition. Steven Bang [22] invented automatic baby rocker having a noise sensor to detect baby cry. Noise sensor consists of Electric MIC with a pre amplifier. Signal from noise sensor is fed to microcontroller, which is used to control the DC motor. Few colourful lights made up of LED are used to entertain the baby while being rocked [2].

Madhuri P. Joshi1 [26] Automatic baby rocker was then invented which consists of noise sensor for baby cry detection. Hence the crib would rock automatically if baby cry sound is detected. The Arduino Atmega328 microcontroller which would receive the signal from noise sensor was used to control DC motor to rock the crib. Colorful LED lights were used for baby's entertainment. Also cradle had 6 speeds for rocking motion [23]. An algorithm for self sway-adjusting bassinet was then proposed. Here bassinet is made up of sensor network which will adjust swaying. It also gives different signals to control circuits if baby is crying inside bassinet. On detection of baby cry sound, bassinet starts swinging. Its rhythm can be adjusted automatically with use of three pressure sensors which are located at the bottom of bassinet. Two sensors are at left and right of the bottom and one at the centre [25].

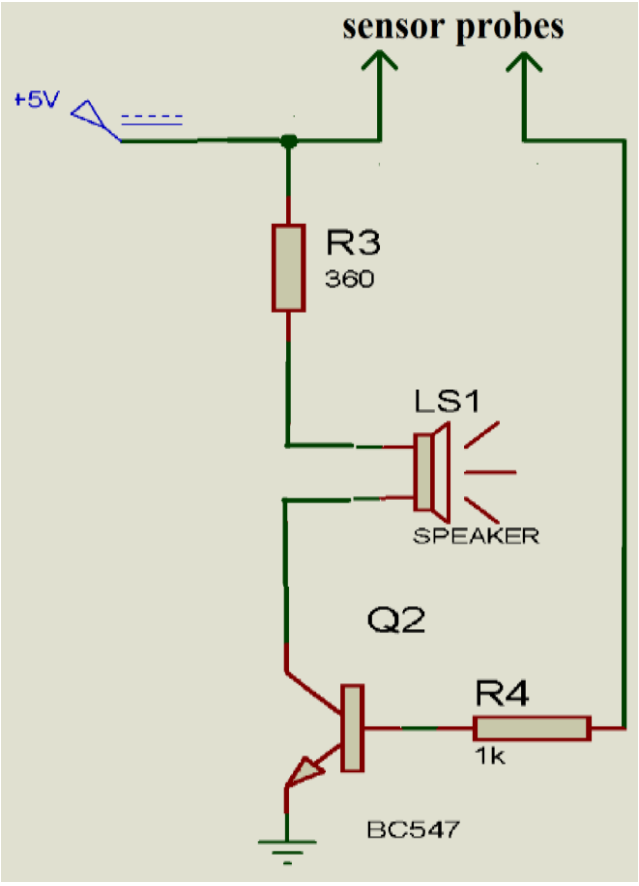

Figure -3. Wet Sensor based cradle circuit diagram

Wet Detection in Baby Cradle System

Rachanapalaskar [13] has determined the moisture condition i.e. urine detection by using two pairs of copper electrodes which are placed under the cloth on which baby is sleeping. The signal obtained is given to microcontroller. When urine is present switch is closed transistor turns on. When urine is absent switch is open, transistor turns off. Thus, if mattress gets wet, Alarm is buzzed to alert parents.

Alpha Elizabeth [20] John, has proposed a system in which the wetness is detected by LM35 sensor and the information is sent via RF transmitter to the Angel care handy receiver. In the Angel care handy receiver, we have used another microcontroller (PIC12F675) which on reception of the signal through the RF receiver drives the LEDs. Care has been taken that the wet detection circuit operates on low voltage levels to reduce the risks of baby experiencing discomfort. A separate small battery has powered the wet detection circuit.

Rajat Arora [11] proposed the usage of three sensors which makes sure that the baby is overall secured unlike other smart cradle which focuses on one of the functionality not ensuring full security. Ruchi Khant [24] the wet detection circuit is basically a stable multivibrator circuit with a break in its path in the form of detector. Detector is actually two plates with a break in between hence when a liquid falls in the path, it completes the conductivity route and hence generation of waveforms occurs. They cause the LED in the output to blink till the path is connected. Aquib nawab [12] has used a simple voltage divider as a wet sensor to detect the resistance and if the resistance below a certain limit we will let the serial monitor print that there is moisture detected.

To develop a PCB for wet sensing first of all we dropped on HDR connecter on the new file and send it to the ultiboard. Anritha Ebenezer [26] To make this cradle system more advanced, proposed use of GSM technology in which cause of alarm can be sent as message to the parent if wetness is detected. Rachanapalaskar1, [21] has deduced a method for the moisture condition i.e. urine detection, by placing two pairs of copper electrodes under the cloth on which baby is sleeping. The signal obtained is given to microcontroller. And this further transfers it control to the alarm buzzer.

Anritha Ebenezer [22] has designed the wet sensor which has a PCB design where copper cables are embedded on it, hence whenever the wetness is detected the resistance would change and corresponding signals will be passed to the

microcontroller. This in turn sends the signal to the display. Aquib[21] suggested A mesh like structure was produced on to a copper clad board the cross section was comprised of two leads with extended structures. In other vicinity of Bed-wet condition, the leads were associated with a 5V force supply through the resistance of 55 kilo-ohms. The yield of the framework was taken from the 55kilo-ohm resistance and the lattice lead. The yield was associated with the AIO information of the Arduino UNO board. Under typical circumstances the lattice surface will carry on as open circuit and the yield of the sensor will be 5V. On account of Bed-wet condition, there will a drop in the yield voltage. Prof. A.D. Anjikar [9] has used ABS + Sensor Chip for wet detection. He placed wet alert bedside or other suitable places, placed the alert's sensor chip under baby's diaper. Turn the switch to NO. Once baby pee, the alarm will remind parents immediately with the music to changing diapers. Then turn the switch to OFF, disarm the alarm.

Temperature in Baby Cradle System

Alpha Elizabeth [18] John, has proposed a system in which the temperature is detected by LM35 sensor and the information is sent via RF transmitter to the Angel care handy receiver. In the Angel care handy receiver, we have used another micro-controller (PIC12F675) which on reception of the signal through the RF receiver drives the LEDs.

Aquib Nawaz [12] uses Surface temperature sensor for sensing the temperature of the babies. The surface temperature sensor is used for measurement of body skin temperature. It has exposed thermister that results in an extremely quick time. This design allows only for air and water. Temperature range: –25 to 125°C (–13 to 257°F) Maximum temperature that the sensor can tolerate without damage: 150°C. Anritha Ebenezer,has [19] developed a system to continuously display the temperature of the baby and in case the temperature goes beyond or below the normal temperature, this will be known via the display.

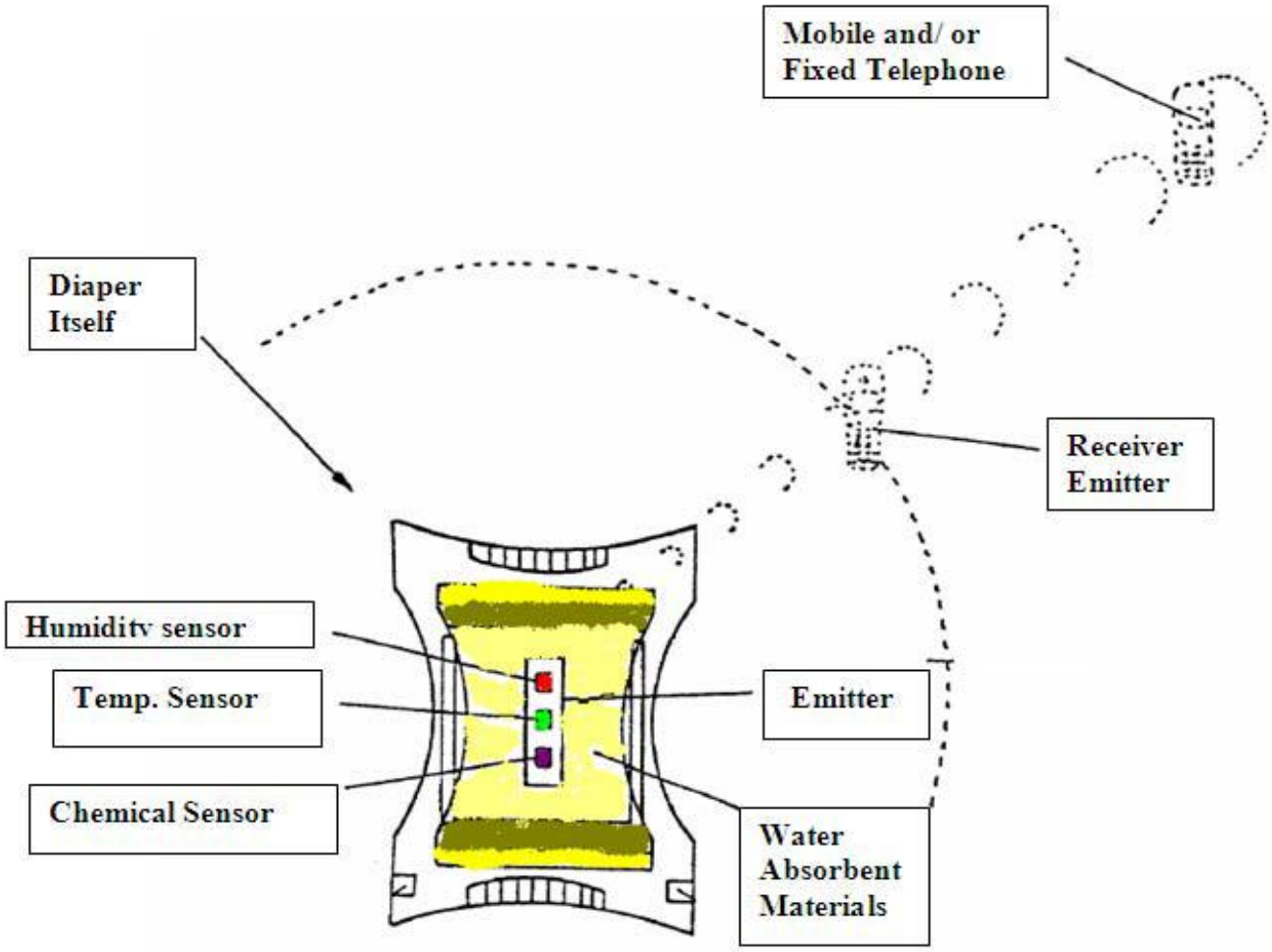

Figure- 4. Temperature based cradle system

Table-1. Schema of existing baby cradle systems

S.No	Name	Title	Work
[1]	Alpha Elizabeth John, NajiyaKundukooli, Neema P and Aleena Jose	Embedded Baby Monitor	Cradle module and Angel Care Handy Receiver
[2]	Lejin P Reji, Kuruvilla George RamachaThykkadavil, Mathew Joseph, Vishnu Vijai,	Design and Fabrication B-Care	baby crib or cradle adapted to be rocked automatically by an oscillatory action
[3]	R. Dinesh1 V. Murugabalaji2 P. N. Sundarajan3	Analytical Modelling and Design of a Mechatronic Cradle System	new automated oscillating cradle focuses to swings automatically when baby cries
[4]	Rachanapalaskar, AkshadaWagh, Shweta Pandey, Ashwini	Smart Cradle Gear to Ensure Safety of Baby in the Cradle	a method which would also oscillate the cradle based on the cry intensity
[5]	Chun-Tang Chao, Chia-Wei Wang, Juing-ShianChiou * and Chi-Jo Wang	An Arduino-Based Resonant Cradle Design with Infant Cries Recognition	Cradle with cry detection
[6]	PrajapatiMitesh , Patel Gopal, Modi Kishan	Design & development of automatic baby cradle	baby cradle system which basically focuses on the oscillation of the cradle
[7]	Nitin Bhatnagar, KshitijShinghal, Amit Saxena, Niket Tiwari, Shubham Bhatnagar, Shushant Kumar UG Scholars	E-cradle	crying sound of the baby as the input and produces the amplified sound
[8]	Misha Goyal Dilip Kumar ACSD, CDAC Mohali, Punjab INDIA	Automatic E-Baby Cradle Swing based on Baby Cry	calculated the maximum sound the baby has to produce for the cradle to start working
[9]	Prof. A.D. Anjikar, Alkesh R. Vaishnow, Amol I. Warade,Shubham B. Nishane.	Analysis and Synthesis of Smart BASSINETS for Infants.	Slider- Crank Mechanism for the oscillation of the cradle. ABS + Sensor Chip for wet detection
[10]	fanchaomeng, yuliu , xiaoyelu, kirusri	Smart baby cradle	Smarter baby cradle with wet detection
[11]	Rajat Arora Heli Shah Rohan Arora	Automatic baby cradle and monitoring for infant Care	three sensors which makes sure that the baby is overall secured
[12]	Aquib Nawaz	A Survey on Advancement of Baby Cradle	simple voltage divider as a wet sensor to detect the resistance
[13]	Rachanapalaskar, AkshadaWagh, Shweta Pandey, Ashwini Telang	Embedded Baby Monitor	moisture condition i.e. urine detection by using two pairs of copper electrodes
[14]	Madhuri P. Joshi, Deepak C. Mehetre	Automatic Cradle Movement For Infant Care	Cradle automatic rocking for baby care
[15]	Alpha Elizabeth John, NajiyaKundukooli, Neema P and Aleena Jose	"Rock Me Baby: The Automatic Baby Rocker"	wetness is detected by LM35 sensor
[16]	Rachanapalaskar1, Akshada Wagh2, Shweta Pandey3, Ashwini Telang4	Automatic baby cradle and monitoring For infant care	a method for the moisture condition using copper electrodes
[17]	Anritha Ebenezer &Anupreethi. S	Design and Implementation of Automated Cradle	wet sensor which has a PCB design with copper cables
[18]	Alpha Elizabeth John, NajiyaKundukooli, Neema P and Aleena Jose	Embedded Baby Monitor	system in which the temperature is detected by LM35 sensor
[19]	Anritha Ebenezer &Anupreethi. S	Automatic Cradle Movement For Infant Care	a system to continuously display the temperature of the baby

[20]	Rachanapalaskar1, Akshada Wagh2, Shweta Pandey3, Ashwini Telang4	Automatic baby cradle and monitoring For infant care	the Environment temperature sensor which detects the temp
[21]	Aqiwb nawaz	Development of an intelligent baby cradle for home and hospital use	A mesh like structure with copper cables for wet detection
[22]	Rachana Palaskar1, Shweta Pandey2, Ashwini Telang3, Akshada Wagh4, Ramesh M. Kagalkar5	An Automatic Monitoring and Swing the Baby Cradle for Infant Care	DC motor can offer movement motion according to its rated power

Rachanapalaskar [20] has detected the Environment temperature sensor operates at 5 V and can measure temperatureupto125 C which is sufficient for the targeted environment temperature range. If the temperature is too high, parents can monitor through webpage and switch on the fan or AC when required.

Aquib Nawaz [21] observed the body temperature of the new conceived children is of awesome significance, particularly for the untimely and basically sick babies. Remembering this numerous scientists are attempting to create temperature checking framework. In this paper, a NTC thermistor was utilized for outlining a temperature checking framework. Resistance of thermistor is nonlinearly and conversely identified with the temperature which permits to focus little temperature variety at lower temperature range. The surface temperature sensor STS-BTA is a 23 uncommon kind of thermistor which has the extra thermistor to detect the temperature it has benefit of high accuracy and flexibility. It is limited uses in water and air.

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