

Development of IoT Based Smart Baby Cradle

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Abstract: The cornerstone of our project is Women Empowerment; by providing them with an Automatic Baby Monitoring System, with a special focus on developing countries. This project is the personification of a Smart Baby Cradle, brought about by integrating distinctive features i.e. automatic cradle swing (using cry detection system), interactive toys and communication module (for monitoring purposes), in a single unit. The current era of digitization provides a large-scale availability of data as well as computing capability which can be used to bridge the gap between a child and a working mother. This paper proposes the use of "Smart Cradle" an E-Cradle which involves the use of Internet of Things. The proposed solution involves live monitoring of the child through a mobile application remotely. The smart cradle incorporates the use of PIR sensor for monitoring the movement of the child; Noise sensor for the detection of the child's crying activity and automatically swings the cradle to soothe the child. The DHT sensor notifies the parent about the body temperature of the child via text message, when the temperature goes above the set threshold. The solution also includes moisture sensor to maintain the hygiene of the child. The proposed system uses the cloud service for remotely monitoring the child.

Keyword: E- Cradle, Internet of Things, Cry Detection, Sensors, Automatic Baby Monitoring

I. INTRODUCTION

Generally, the baby cradle is used for to make sleep and soothe to baby. For example, guardians have to take care of their child till as they asleep. However, conventional cradle does not electronically equip such like battery or adapter to automate the cradle automatically. In addition to that, these kinds of conventional cradle are used in villages areas or non-developed cities due to its low prices. But the problem of this kind of designated cradle is that you need manpower to take care of your child and your child may not be safe and feel comfortable in the conventional cradle. Thus, we need automatic cradle to take care of child which uses the battery or power source. The smart baby cradle helps working women balance their work and domestic chores. It creates a positive impact on society as women can continue their studies or job without worrying about their children and can take part in development of the nation. Besides, there are extra features or function is provided by the newly automatic cradle that is beneficial for parents. Because in the present world people are very busy in their professional life so they do not get ample time to take care of their infants. It will be very difficult to control the babies and if someone is hiring professional to take care of their infants. It may increase your expenses from monthly expenditure. Moreover, in today, life it is very hard to even for the homemakers (mummy) to sit nearby their babies and sooth them whenever they feel uncomfortable. Hence, the use of Internet of Things helps in dealing with this problem. Smart cradle system for child monitoring using IoT allows parent to monitor the child through the Mobile application.

The scope of this work is to make a smart, safe and economic cradle for infants making them comfortable. The main circuits used for this work are PIR sensor, Noise sensor, Moisture sensor, Servo motor and Temperature sensor. The PIR sensor is used for the movement of the baby and will make the cradle swing back and forth by sending a signal to the servo motor. The proposed work implements a Smart Cradle System using cloud services for monitoring the baby inside the cradle and measuring the body temperature, measuring bed wet condition and using PIR sensor to locate the position of the child with respect to the cradle. Thus, the project bridges the gap between the working parent and their child. There are certain products named "Smart baby cradle" which are conventional models using constant mechanism to address baby's distress. The purpose of this project is to reduce the physical interface of the working parents with greater reliability, efficiency, better adaptability, security and cost effectiveness. The entire system works with the purpose of providing convenience by continuously monitoring every activity of the infant and thereby providing real time details and updates to the parents. This system can be marketed among the general audience as it is very reasonable and every person from different backgrounds and culture can afford it.

II. LITERATURE SURVEY

[1] The proposal for an infant and child-friendly health monitoring system was made. The proposed system detects the body temperature, moisture content in the bedding structure. The signal conditioning is done by the operational amplifier. The proposed system provided live monitoring of the child and included a toy to sooth the child and provides rotatory motion using DC motor. The basic drawback in this proposal is that it lacked android application where the data calibrated from the sensors can be displayed.

[2] It gives all the motion that can be given by the mother with the voice and motion sensor control through mobile. The device can be used in any height within a range and can be moved from one placed to another by castors attached to the frame. The sensor is located at the bottom side of the bed so swing doesn't occur smoothly.

[3] The proposed solution involves live monitoring of the child through a mobile application remotely. The limitation of the proposed system is that it fails to contain rocking motion and rotary motion of the cradle.

[4] Manisha et. al. presents a framework for self- regulating baby cradle which consists of a microphone that detects the cry of the baby. To convert it into electric signal, the electrical device operational amplifier is used for amplifying signal conditioning circuit. A microcontroller is utilized to receive the amplified signal and to transform to digital signal. Microcontroller monitors the driver circuit that begins a motor and swings the baby crib.

[5] This system reduces the work of working parents as well as in hospitals where there are large number of babies. The real downside is that the sound locators are not utilized and in this manner sound recognition is beyond the realm of imagination. Presence of camera and toy lacks in the proposed system which in turn makes video communication difficult.

[6] The project idea develops from the very fact that a woman finds it difficult to concentrate on her child owing to her busy schedule of house life. many devices are available to ease her task and help her to balance between her work and the need of her child. The Automated cradle proposes to be one of them. The proposed model uses IR wireless technology for less complexity and easy access and the slider crank mechanism used for the swing makes the transition smooth. The user can control the swinging speed of cradle by a remote. The proposed model lacks in providing sensor interfacing to measure the temperature and cry detection of the infants.

[7] Nawaz Aquib. proposes a rocking motion for the sleeping baby which looks into degree of rotation, speed, and all other data drivers that are accountable for swing advancement.

[8] This paper presents a brand new approach in coming up with associate automatic swinging cradle system. The system has inbuilt alarm that indicates two conditions – first when the mattress is wet n, which is an important parameter to keep the baby in hygienic condition, second when baby does not stop crying with a stipulated time, which intimated that baby needs attention. The drawback of the proposed module is that it fails to provide rocking motion and two- way swing mechanism.

[9] The project work is aimed to develop a reduced working model of a baby cradle system for making baby comfortable in a single room while sleeping. The simple crank mechanism is used for driving the cradle and sensor are implemented for automation. The cradle is fabricated to suit the new born baby.

III. PROBLEM STATEMENT

- Mechanical design for providing specified types of motion to baby;
- integration of electronics with the device
- 27% of mothers struggled more with baby cry.
- Exhausted parents: 71% of mothers said lack of sleep is the hardest of having a new born.
- Baby's up a lot at night.
- Stressed baby: Baby stress increased if instant taking care is not taken.
- Disturbance during cooking and office work.

IV. OBJECTIVES

- To design the development of an smart baby cradle, which has ability to monitor baby movement, bed-wet condition and body temperature.
- To make a baby cradle safe and comfortable for baby with the use of various sensors to detect the movement of the baby body as well as bed-wet condition to keep away baby from unhygienic environment.
- To make cradle innovation that is more flexible and less expensive to Indian market.

V. METHODOLOGY

5.1. Concept to be developed in the Project

Mechanical Design

- Motions suitable for babies.
- Multiple motions.
- Portability and foldability.

Making it Smart (Electronics)

- Remote Control

5.2. Working

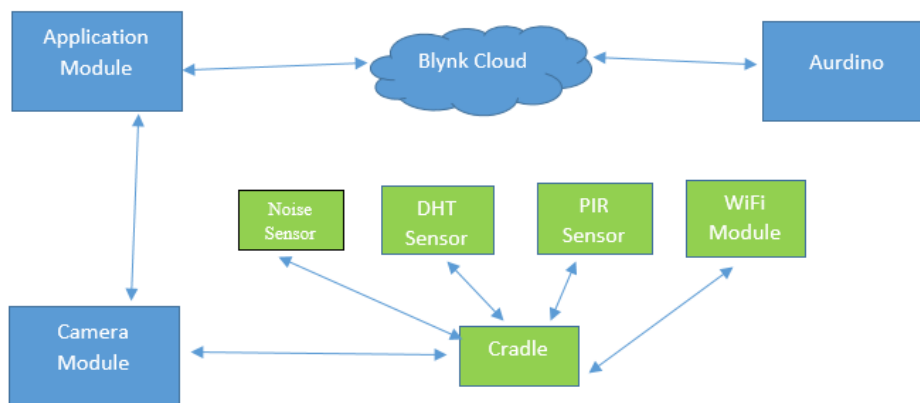


Fig.1. Block diagram of the proposed system

- The above diagram depicts the complete working of the smart cradle system. When the child is made to sleep on the cradle various sensors like noise sensor, DHT sensor, PIR sensor and camera module are implemented to monitor the various actions of the child.
- The equipment Baby care includes a dc motor, link, and an oscillating bed and sensors. The electric powered motor will actuate the links by shaft. Links actuates the rod attached to the bed at constant speed.
- The carriage is attached to the metal rod through springs which will provide a vibratory motion. It will also ensure the cradle motion even when the baby cries or moves using sensors. Motor, link and sensors are attached to the side of the cradle frame.
- When the motor rotates in clockwise direction it pushes the bassinets to front side & when motor rotates in anticlockwise direction it pushes the bassinets on the Either side. And in this way the system will keep working.
- Baby Cradle 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.

5.3. Sensors Interfacing

Noise sensor: The noise sensor is used to detect the sound level of the baby’s cry and if the sound level is higher than the threshold value, an amplified signal is sent to the servo motor for automatic swinging of the cradle.

DHT sensor: DHT sensor is used to measure the temperature and humidity of the cradle. The main aim of using DHT sensor is to get the current temperature of the atmosphere around the baby. For instance, the temperature is above 22 degree it causes a discomfort to the baby that time the parent can pay attention to the baby by swinging the cradle through the mobile application.

PIR sensor: PIR sensor is used to detect the movement of the child inside the cradle. When the child turns to right or left the current status is sent to the mobile application. If the baby is uncomfortable inside the cradle the movement of the baby inside the cradle will be changing continuously

Wifi Module: A Wifi module is used to connect the sensors of the cradle system to the Blynk cloud services via Arduino.

Arduino: Takes the signal from the Wifi module sends the data to the Blynk cloud. The Blynk Cloud sends the data of the sensors to the mobile application.

Camera module: The parent will be able to speak to the child through the mobile application which is connected to the camera. The parent will be able to see the child live on his/her mobile application.

5.4. Frame Design

Total weight on Arm= 20kg

Material:- MS 1018

Circular 12mm diameter 1.5 thick

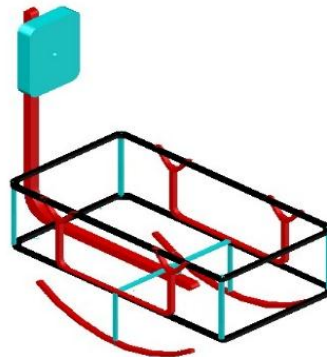


Fig 2. Isometric view of Cradle

5.5. Moment Arm Design

Total weight on Arm

= Baby weight + Bassinet weight

= 15kg + 5kg

= 20kg = 200N

MS 1018 Circular 25.4 mm diameter 1.5 mm thick

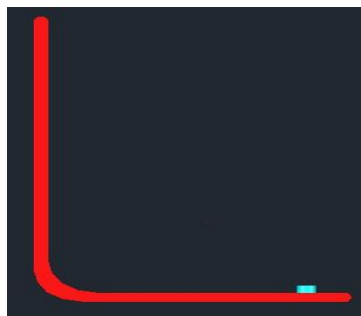


Fig.3. Moment arm front view

5.6. Material

MS 1018, cold drawn

Density: 7870 kg/m³

Tensile yield strength: 370 MPa

Tensile ultimate strength: 440 MPa

Compressive yield strength: 250 MPa

Poisson's ratio: 0.29

5.7. Specifications

Modulus of Elasticity (E): 205GPa Bassinet dimension: 80 x 45 x 25cm

Mat Dimensions - 75 x 40 cm

Max baby weight: 15kg

Swing Direction: Rocking @ X, Rocking @ Z

Single Actuator

Plug in Power

Frame Material: MS 1018 Cold Drawn

VI. CONCLUSION

- Looking after babies is hard problem worldwide. This system emphasizes the importance of child care. The above designed is economical and user friendly and very useful for working mothers and nurses. They can manage their work efficiently.
- The present work reduces the human effort and particularly mother's stresses in working times. The equipment Baby care includes a motor, sensors, and oscillating carriage.
- The overall mechanism is mobile which allows easy movement from room to room. The electric powered motor will actuate the links by shaft and the links actuates the bed in a constant speed which is attached to the carriage.
- The advantage of this device is its low initial cost, and has allowed operating cost. The device affords plenty of scope for modifications for further improvements and operational efficiency, which should make it commercially available and attractive.

REFERENCES

- [1]. "Automatic E-baby cradle swing base on baby cry" by Misha Goyal IJCA Volume – 71- No. 21 ACSD, CDAC Mohali, Punjab INDIA and Dilip Kumar ACSD, CDAC Mohali, Punjab INDIA June 2013.
- [2]. "Design and fabrication of automatic baby cradle system" by Tushar P. Patekar Volume- 05 Issue 02 International Research Journal of Engineering and Technology (IRJET) 02 | Feb-2018.
- [3]. Smart Cradle System for Child Monitoring using IoT by Amol Srivastava, B. E. Yashaswini, Akshit Jagnani, Sindhu K International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-9, July 2019.
- [4]. "Intelligent Baby Monitoring System" by Savita P.Patil, Manisha R. Mhetr Volume- 2 Issue-1 pp. 11-16, 2014 Instrumentation Dept. VIT , Pune, Maharashtra, India 2014.
- [5]. "Automatic Cradle System for Infant Care" by Vedant Krishna Sambhar, Prof. M. B. Tadwalkar ISSN: 2319-8028 Vol-6 Issue- 4 April. 2017.
- [6]. "Design of automatic and Indigenous Baby cradle" by Dr. Kshitij Shinghal IJTR Volume- 2, Issue- 6, 2016.
- [7]. Nawaz, Aquib. "Development of an intelligent baby cradle for home and hospital use." PhD diss., 2015
- [8]. "An Automatic Monitoring & Swing the Baby Cradle" by Rachana Palaskar D.Y.Patil School of Engg & Technology, Lohgaon, Pune Dec 2015
- [9]. "Design and Fabrication of baby cradle" by Prof. A. D. Anjekar ISSN: 2321-9653 Volume- 7 Issue III March 2019 Department of Mechanical Engineering, Priyadarshini Bhagwati College of Engineering, RTMNU.

Reference Books

- Design of Machine Elements by B.D Shivalkar
- Machine Design by Khurmi Gupta
- Design Data Book By B.D Shivalkar