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Review on Air-Permeable Cradle

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ABSTRACT: The safety and comfort of babies are the top priorities in the design of an air-permeable cradle. This creative cradle has a special mesh structure that breathes well to provide maximum ventilation, lowering the possibility of asphyxia and encouraging a restful sleep environment. Breathable materials used in the cradle also aid in temperature regulation, keeping babies warm but not overheated. It is the ideal complement to any nursery because of its soft rocking action, which puts newborns to sleep. Parents can also rest easy knowing that the cradle's transparent sides provide a clear view of the infant from every angle. This air-permeable cradle is the best option to guarantee your child's health and sound sleep.

KEYWORDS: ESP-32, Cradle, Air quality sensor, Ventilated fan, Arduino IDE

1. INTRODUCTION

When it comes to baby care, nothing is more important than our children's security and welfare. In order to offer our infants the greatest environment possible for them to develop, we as parents, guardians, and caregivers are always looking for creative ways to solve problems. In this context, we present a revolutionary development in baby bedding: the air-permeable cradle. This amazing invention redefines how we put our babies to sleep by combining ease, safety, and comfort while providing an unmatched level of peace of mind. The air-permeable cradle's primary novelty is its distinctive design, which prioritizes safety. The construction of the cradle is made of permeable mesh, which allows for ideal air circulation in the sleeping area. This essential component greatly lowers the possibility of suffocation, guaranteeing your child's uninterrupted, restful sleep. This cradle establishes a new benchmark in a world where baby safety is of utmost importance by guaranteeing a safe and ventilated sleeping area. More than just a piece of nursery décor, this airpermeable cradle is a symbol of the steadfast dedication to the protection and wellbeing of newborns. Its translucent sides give you a clear view of your infant from every aspect, giving parents constant peace of mind. Come along with us as we explore the world of air-permeable cradles, where peace of mind and safety combine to provide the best sleeping environment for your priceless kid. This cradle, which sets a high bar for comfort, innovation, and peace of mind, symbolizes a new age in baby care. Choosing a cradle for a baby is an important option parents make to ensure a secure and comfortable sleeping environment. This air-permeable cradle is more than simply a decorative item for a nursery; it represents an unwavering commitment to the safety and well-being of infants. Parents may observe their newborn clearly from every angle because to its translucent sides, which provide them with constant peace of mind. Join us as we investigate the world of airpermeable cradles, where safety and peace of mind come together to provide the ideal sleeping environment for your precious child. This cradle represents a new era in newborn care since it sets the standard for comfort, creativity, and ease of mind.

Infant suffocation is a heartbreaking tragedy, and there are several potential causes to be aware of:

- Sleeping position: Babies placed on their stomach or side are at higher risk of suffocation compared to sleeping on their back.
- Overheating: Excessive layers of clothing or warm bedding can overheat an infant, leading to increased breathing difficulty.
- Prematurity: Premature babies have underdeveloped lungs and are more susceptible to breathing difficulties and suffocation.
- Rolling Over: As infants begin to roll over, they may unintentionally roll into a position that hinders their ability to breathe. While this is a natural developmental milestone, it underscores the importance of keeping the sleep environment free of potential obstructions.
- Inadequate Ventilation: Poorly ventilated sleep environments, especially in enclosed spaces or when using heavy, non-breathable materials, can contribute to insufficient airflow, increasing the risk of suffocation. The objectives for an air-permeable cradle for infants encompass safety, comfort, and convenience: First and foremost, the primary objective is to provide a safe sleep environment for infants, reducing the risk of suffocation by ensuring optimal airflow. This

involves the implementation of breathable mesh materials that maintain a consistent flow of fresh air while the baby rests. Secondly, the cradle aims to maximize comfort for infants. It should have a well-padded, soft mattress and a temperature-regulating design to keep the baby cozy without overheating. The gentle rocking or motion feature, when included, intends to soothe the baby and promote restful sleep. Another objective is to enhance convenience for parents. This may include features like transparent sides for easy monitoring of the baby, adjustable height options, and easy portability to move the cradle around the house. Ultimately, the overall goal of an air-permeable cradle for infants is to create a secure, comfortable, and user-friendly sleeping space that promotes the well-being and restful sleep of both the baby and their caregivers.

Mobile Ad Hoc Networks (MANETs) consists of a collection of mobile nodes which are not bounded in any infrastructure. Nodes in MANET can communicate with each other and can move anywhere without restriction. This non-restricted mobility and easy deployment characteristics of MANETs make them very popular and highly suitable for emergencies, natural disaster and military operations.

Nodes in MANET have limited battery power and these batteries cannot be replaced or recharged in complex scenarios. To prolong or maximize the network lifetime these batteries should be used efficiently. The energy consumption of each node varies according to its communication state: transmitting, receiving, listening or sleeping modes. Researchers and industries both are working on the mechanism to prolong the lifetime of the node's battery. But routing algorithms plays an important role in energy efficiency because routing algorithm will decide which node has to be selected for communication.

The main purpose of energy efficient algorithm is to maximize the network lifetime. These algorithms are not just related to maximize the total energy consumption of the route but also to maximize the life time of each node in the network to increase the network lifetime. Energy efficient algorithms can be based on the two metrics: i) Minimizing total transmission energy ii) maximizing network lifetime. The first metric focuses on the total transmission energy used to send the packets from source to destination by selecting the large number of hops criteria. Second metric focuses on the residual batter energy level of entire network or individual battery energy of a node [1].

II. LITERATURE REVIEW

N. L. Pratap, K. Anuroop et.al., [1] proposed a method to overcome the difficulties of baby care that has increased for working moms. An Internet of Things-based smart cradle keeps an eye on the infant's oxygen levels, temperature, humidity, and heart rate .It includes a number of sensors, including gas, sound, temperature, and pulse sensors. The Raspberry Pi is utilised to install a video surveillance system, while the S.ODI board is used for data processing and control. A flow chart is part of the system architecture to keep track of the baby's condition. In response to the baby's condition—such as crying, temperature, and pulse rate—the system notifies parents and physicians. The goal of this technology is to give working mothers and other carers access to real-time health and comfort monitoring and control.

Monira Mukta et.al., [2] developed the smart cradle, the infant can be remotely monitored in real time via a smartphone application. It makes use of sensors to keep an eye on the baby's vital signs, including breathing, temperature, wetness, and crying. Additionally, the cradle has a noise sensor built in to recognize when a child is crying and begin swinging the cradle automatically to calm them down. To keep an eye on the baby's condition, it has an external web camera, a moisture sensor, and a temperature sensor. With its 2-in-1 design, the cradle may be used as a dynamic table to facilitate diaper changes. The sensors in the system are connected to a mobile application server via a wireless local area network module. With the use of cuttingedge research and algorithms, the smart cradle may be further enhanced to monitor critical metrics in the NICU and PICU, incorporate facial recognition, and distinguish between cry patterns.

S. Joseph et.al., [3] proposed a method for the creation of a Smart Cradle System that uses IOT to remotely monitor babies is covered in the document. The system consists of modules such as the Raspberry Pi, Arduino Camera, Swing Automation, Humidity and Temperature sensors, Cry Detecting Mechanism, Live Video Surveillance, and Data Storage. An automated baby care room that uses sensors and a microcontroller to save time and energy for working parents is another idea. Additionally, an Internet of Thingsbased wireless health monitoring device for neonates is suggested. The Raspberry Pi, sensors, and camera are just a few of the components that make up the system's detailed hardware needs and operation. The system seeks to address the shortcomings of the existing ones, which are more expensive and less user-friendly.

M. P. Joshi and D. C. Mehetre M [4] proposed a Smart Cradle i.e intended to monitor and swing on its own, alerting parents via a smartphone app when something goes wrong. The system communicates wirelessly by RS-232 or zigbee with a PC or cloud server, utilising a microcontroller to control hardware and signals. The system includes a revolving toy for the baby's enjoyment, a buzzer, and sensors for moisture and noise. Algorithms for warning generation, remote monitoring, and threshold value setting are also included in the system. When compared to conventional cradles, the method has proven to give the baby more security and attention. The Smart Cradle has been compared to other monitoring systems and cradles and is created with Android technology.

W. A. Jabbar et.al., [5] proposed the method of the creation of an Internet of Things-based baby monitoring system for Smart Cradle is covered in the article. The method is made to help working parents with the difficulties they encounter when keeping an eye on their children. It has a video camera for in-the-moment monitoring, a tiny fan for ventilation, and a cradle that swings when the sound sensor senses crying. The parents can access the system at any time and from any location thanks to a MQTT server. The system can be produced in large quantities because its total cost is about RM 700 per unit. The writers are proficient in digital/adaptive filtering, voice and audio processing, algorithm development, and communications technologies.

S. Kavitha et.al., [6] proposed a method for the application of the Internet of Things (IoT) to the development of a Smart Cradle for infant monitoring is covered in this study. A overview of the different sensors and actuators utilised by the Smart Cradle system is included. For the purpose of monitoring infants, a variety of methods and tools are suggested, such as cry detection, moist detection, temperature sensing, and sound and eye detection systems. In order to remotely regulate facilities and provide parents realtime alerts, the system also makes use of GSM technology. In order to overcome the difficulties experienced by working parents, the article offers insights on the automation of baby monitoring and care.

Aliya Batool et.al., [7] proposed a method to create a "smart cradle system" that will protect and comfort newborns while bridging the gap between parents and children. The IoT-based solution uses a deep learning model to lessen the possibility of hazardous situations. The baby's heart rate, movements, moisture, and sound are all tracked by a number of sensors and modules included into the cradle. For the early identification and treatment of hazardous circumstances in newborns, the integration of Internet of Things-based applications in smart cradle systems is crucial. The application of deep neural networks to identify common movement patterns in motion data is also covered in this paper.

M. Rajesh et.al., [8] proposed a smart cradle system that monitors the baby's environment and identifies unusual activity using ultrasonic, temperature, and humidity sensors. It has a video camera that records and broadcasts live video to the parents using instructions from the microcontroller. The system also gathers data from sensors such as temperature, ultrasonic, and raspberry pi location sensors, displays the baby's condition, and notifies the appropriate guardian. In order to ensure the comfort and safety of the infant, the system attempts to give working parents remote access and surveillance.

Siddharth Sharma et.al., [9] proposed a method, in order to reduce the work that parents and guardians must do, the article presents the idea of an intelligent infant cradle. In addition to a motor and MP3 player for calming the infant, the cradle system has sensors for temperature, dampness, and movement in the baby. When a baby need attention—for example, if they are crying or have wet the bed—the system notifies the parents. The writers are Bharati Vidyapeeth Deemed University students who have a passion for image processing, electronics, and telecommunication.

Syed Amir et.al., [10] proposed the project to lessen the difficulties that parents encounter in raising and supervising their children while working. The smart cradle has a swinging mechanism that begins to swing on its own when it hears a baby scream. It also features an autonomous toy for the baby's pleasure, a wetness sensor, and a camera for ongoing surveillance. To satisfy modern needs, the system is integrated with sound sensors, Arduino, and other electronic parts. The suggested solution offers parents constant monitoring and surveillance at a reasonable cost and is easy to use. The project is complete and contains pictures showing how it was carried out.

V. Suresh Kumar et.al., [11] developed a single device that can reliably monitor the heart rate, skin temperature, oxygen saturation, and other physiological indicators. Because of its ease of use and minimal training requirements, the system is a good fit for working parents who find it difficult to juggle work and daycare obligations. The system uses sensors and actuators to measure and control a variety of operations, like an electronic sphygmomanometer. In order to serve patients in remote areas with remote medical care and monitoring, the system also has a telemedical component. The system's functionality, including patient monitoring and data transmission communication, has been examined and

evaluated. With the use of wireless sensors and a modified CP-ABE algorithm for secure transmission and access control, a secure automated patient monitoring system has been created.

Kaushalya Thopate et.al., [12] proposed a cost effective project with the help of the Internet of Things, parents may remotely monitor and alter their baby's sleeping environment using the Smart Cradle. It can produce insights and recommendations based on gathered data and interfaces with other smart home appliances. An IoT platform called Thing Speak gathers, examines, and displays data from IoT devices in real time. Raindrop sensors, microphones, and Wi-Fi microchips are some of the parts that the Smart Cradle employs for monitoring and alerting. Test scenarios are included in the system to assess how well it can identify and alert parents to occurrences of dampness and crying. The Internet of Things (IoT)-enabled smart cradle can be used to monitor and control a baby's sleep routine at home, in hospitals, and in neonatal units.

Ms. Diya Karkhanis et.al., [13] developed a cost effective system for the smart cradle system keeps an eye on and tends to babies using a variety of sensors and modules. The Arduino Uno, GSM module, ESP 32 Camera module, sound sensor, moisture sensor, methane sensor, and contactless temperature sensor are among the components. Algorithms are employed to measure body temperature, keep an eye on room temperature, and inspect diaper conditions. Through constant activity monitoring and real-time information, the technology seeks to make parenting easier for parents. Future plans call for integrating GPS services and improving security to provide expert-level safety

III. PROPOSED METHODOLOGY

A crib type called an air-permeable cradle is generally made to increase air circulation and guard against newborn asphyxia. It is made up of a cradle mattress, an air quality sensor, and other parts that combine to give babies a secure and cozy sleeping environment. All things considered, an air-permeable cradle is a secure and cozy sleeping choice for infants. They are a fantastic option for parents who want to enhance their baby's quality of sleep while lowering the chance of asphyxia.

Material Selection: The procedure starts with a thorough selection of materials that are hypoallergenic and breathable. Mesh materials with superior air circulation are selected for the mattress and sides of the cradle. For these materials to meet safety and health standards, extensive testing is required.

Design and Engineering: The development of the cradle's design prioritizes the enhancement of air permeability. To do this, a mesh structure that preserves structural integrity and permits optimal airflow must be created. To guarantee the stability and security of the cradle, engineering techniques are utilized.

Temperature Regulation: Materials that help control temperature are incorporated into the process. Choosing fabrics that drain moisture away and stop overheating helps achieve this. To make sure the cradle keeps the baby at a comfortable temperature, thermal examinations are carried out.

Safety Testing: An essential component of the technique is thorough safety testing. To ensure that the cradle complies with safety regulations, it is put through a battery of tests, like as assessments of the choking threat, stability tests, and mesh strength tests.

Transparency & Visibility: The baby is visible from any angle thanks to the translucent sides of the design. The cradle's overall structural integrity is preserved while this element is painstakingly integrated to provide parents peace of mind.

Comfort and Calming Mechanism: The technique uses a soft rocking motion that is intended to calm infants and help them fall asleep. This entails creating a rocking mechanism that is effective and safe while still being comfortable.

IV. CONCLUSION

The air-permeable cradle is a ground-breaking invention in baby care that combines comfort, safety, and peace of mind for both parents and newborns. Its distinct design, which places a high priority on excellent air circulation through permeable mesh, greatly lowers the risk of suffocation while simultaneously guaranteeing uninterrupted, pleasant sleep. In addition to its practical uses, this cradle represents an unshakable commitment to the safety and wellbeing of infants. The air-permeable cradle is more than just a nursery item; it provides parents with continuous visual comfort by providing a transparent view from every angle. It embodies a harmonious confluence of safety, innovation, and comfort, setting a new standard for infant care. Selecting a cradle like this becomes a crucial choice for parents,

demonstrating their dedication to provide their priceless child the safest and coziest sleeping environment possible. To put it simply, the air-permeable cradle ushers in a new chapter in baby care history, one in which the marriage of clever design and cutting-edge technology raises the bar for parenting in the future.

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