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IOT Based Smart Cradle Baby Monitoring System

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***Abstract* - In today's digital era, the responsibility of caring for a new born infant turns out to be a difficult task for the modern-age parents as they are busy or indulging in their work so much. Some parents think keeping a nanny or leaving their babies at day-care centers, which results in overall security, hygiene, and maintenance of the baby but these things were not afforded by some parents and, it is not as satisfying as it looks. Therefore, to overcome this problem, we have introduced the idea of making a smart cradle system where the whole system is automated. Also, some doctors mislead the parents with respect to health of new born and make money only playing with their emotions. Nowadays, such cases are arising rapidly in India. So, by doing this project we are working on solving these issues as max possible to all of us. Here we are going to scale the NICU in cradle size. Here we are aiming that everyone can get better healthy environment for their new born baby.**

Keywords: NICU, hygiene, cradle, IoT, Baby monitoring system, Smart cradle baby, infant, Internet of things.

I. Introduction

As we are very well familiar with the hurdles faced by Parents to nurture their infant and especially in case if both the Parents are working. To give 24 hours of time in such cases is next to impossible. Thus, we need to develop something unique that can help Parents to have a continuous surveillance/watch on the Baby/Infant and can notify about the same. Thus, we have come up with an idea to design a Smart Cradle System using IOT which will help the Parents to monitor their child even if they are away from home & detect every activity of the Baby from any distant corner of the world.

All the data which is been taken from the sensors/modules will be stored in Cloud (Google Firebase) & analyzed at regular intervals. It has UI controls which include the feature of controlling the swinging mechanism of the cradle (can be turned on, turned off & can maintain the speed of swing), control for switching on controls for playing the toy/projector whenever the baby cries.

The proposed prototype of smart baby cradle will monitor the activities of the infant. The cradle has motor which will rotate the mobile toy. The smart baby cradle has noise detection which will sense the noise when the baby is crying or making loud noise. A servo motor will rotate (swing) the cradle up to an angle that is safe when infant is inside the cradle. A GSM module to communicate with a remote device that is operated by parents. And an microcontroller to control and monitor the activities of the cradle.

II. Methodology

Figure 1: Methodology

Phase I: Literature Survey and theoretical calculations

In this phase an extensive literature survey will be carried out. It involves collection of literature from various available resources. The required theoretical background needed to understand working of box shifting mechanism and the technologies going to be used in it will be studied. Also the selection of components and power calculations for motor are to be studied.

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Phase II: System Design –Controller design and development of prototype

Design and development of electric circuit from battery to motor and also of safety circuits is to be done. Based on the theoretical data and available resources Prototype will be developed and manufactured as per required specification. And the required tests will be carried out.

Phase III: Design &development of Actual model

This task will be carried out successful working of the prototype with the prototype development. Cad model will be made for the product. Also the dimensions will be justified. The real product, that is smart cradle will be manufactured and assembled which will be ready to work in farm.

Phase IV: Final tests and performance analysis Different types of tests like working swing of cradle, GSM alert with massage sending, working of sanitizer compartment and air cleaner will be studied cycle will be tested also the discharge per charge is find out.

III. Creation and Design of the Real Model

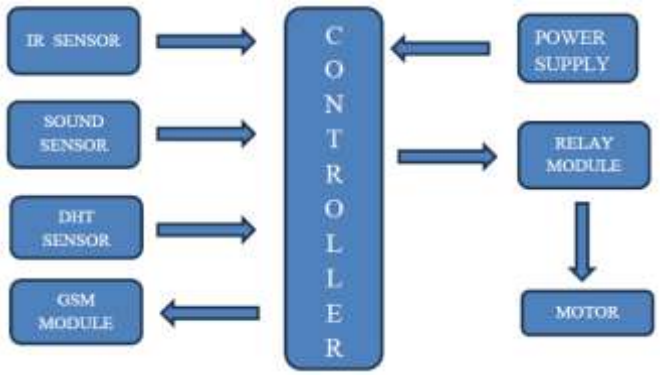

Figure 2: Block Diagram of IOT Based Smart Cradle Baby Monitoring System

IV. Working

Here, in this project we are going to make a simple ergonomically and aesthetically best suit model for our problem statement. i.e. Cradle. Base frame consists of MS metal frame. The cradle compartment is made up of MS structure covered with acrylic glass.

Here we are going to use ATmega328p-pu controller for controlling all input and output. Reason behind using this is we are familiar with its coding and it have enough input and output ports for connection.

We are using 12volt 9apmere battery as power source which can be charged as and when required. For motion od cradle we are going to use wiper motor. (since it has 20kg torque rating)

UV light for killing bacteria inside the cradle. Warm light to keep environment healthy suitable for baby. We are going to use black filming for keeping baby in dark environment in initial days. Also, we provide air filter arrangement to cradle system. Which provides clean air for babies.

We are going to automate environment inside the cradle at normal condition and maintain it through temperature and humidity sensor. As temperature goes above threshold values automatic stabiles using fan arrangement and vice versa.

All these arrangements are done for keeping baby healthy and increase its immune power.

V. Schematic Diagram

This schematic diagram represents the controller circuit for your IoT-Based Smart Cradle Baby Monitoring System, based on the ATmega328P-PU microcontroller. ATmega328P-PU Microcontroller (U1).The ATmega328P-PU is the brain of your system, responsible for processing input signals and controlling output devices.The microcontroller includes multiple digital and analog input/output (I/O) pins, which are used for communication with sensors and other modules.

VI. Advantages

1. Simple in Design – The cradle has a straightforward and user-friendly design, ensuring easy usability without requiring technical knowledge.

2. Rigid Structure – Built with a durable frame (MS metal and acrylic glass), the cradle can withstand daily use while maintaining stability.

3. Easily Maintainable – The components used in the cradle, such as sensors, motors, and microcontrollers, are easily accessible, making repairs and maintenance hassle-free.

4. Operable by Any User – Since the system is automated and user-friendly, even uneducated users can operate it with simple instructions through a mobile application.

5. Waterproof – The design includes protective coverings to ensure the cradle is safe from water damage, preventing electrical hazards.

6. No Risk of Shocks and Short Circuits – Proper insulation and power management make it safe for infants, ensuring no electrical risks.

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7. Helps Healthy Growth of Baby – Features such as temperature control, humidity monitoring, UV light for sterilization, and air filtration create a healthy environment, reducing exposure to germs and keeping the baby comfortable.

8. Keeps Baby at a High Immune Level – The cradle includes a UV light sterilization system and an air filtration arrangement that ensures clean air for the baby, helping to boost their immune system.

VII. Application

1. Domestic individual parent's.

2. Hospital wards

VIII. Future scope

Here as we can look in market its open to all and tremendously scope in it for work since no buddy look in this type to in heal ground problems.

The global baby cradle market was valued at USD 2013.2 million in 2022 and growing at a CAGR of 4.60% from 2022 to 2030. The market is expected to reach USD 2884.9 million by 2030. The increasing popularity and use of baby care products, like cradles, and strollers, are expected to boost the market's growth owing to the rising demand for advanced baby safety products. Furthermore, growing nuclear families, especially in growing countries, will influence market growth. Strict safety standards included by the United States Consumer Product Safety Commission (CPSC) have urged manufacturers to design products with advanced security features which are also expected to push the need for baby cradles, thereby increasing the market growth.

In future we can integrate our project with machine learning that will records all the activity of baby for few days especially baby biological clock and then tells us when baby more likely to urinate or feel hunger etc.

IX. Conclusion

The IOT-Based Smart Cradle Baby Monitoring System is a significant step toward enhancing infant care and parental convenience using modern technology. This project successfully integrates IOT, sensors, and automation to provide real-time monitoring of an infant's environment and activities.

By using ATmega328P-PU as the core microcontroller, along with sensors for temperature, motion, and sound detection, the system ensures continuous supervision of the baby's well-being. The wireless communication module (Wi-Fi/Bluetooth) allows parents to remotely monitor the cradle via a mobile app, ensuring instant alerts for any abnormal conditions. Additionally, the automated rocking mechanism helps so the baby, reducing the need for manual intervention.

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