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Design of Smart Cradle System

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ABSTRACT
This project is aimed at developing an interactive "SMART CRADLE SYSTEM". During the early stages, infants need proper rest and sleep for growth and development. Hence, it is the responsibility of the parents/guardian to provide the necessary care and attention to the infant. But with the modern lifestyle, parents are busy and have a lot of work with little time to provide for their little ones. In today's world we see that most of the families consist of mainly the parents and children. When a baby is born in a family there has to be someone to look after the baby. Some parents have to do a double task of keeping a check on the baby as well as do the household work. Parents in the present world are busy in their work so they do not get sufficient time to take care of their babies. Today's woman has to manage home along with their office work simultaneously. So to help such parents we have decided to come up with a smart cradle which will help a mother or a father have a track of their child and do some household work simultaneously. This project can be used to detect the infant's cry and swing the cradle automatically and also send the alert message to their parents or caretaker and the sensor used in the project will continuously keep on checking whether the baby's mattress is wet or not and send the notification to parent mobile using Server

Keywords: Wet Sensor, Sound sensor, servo motor, arduino uno, nodemcu esp8266, Server.

INTRODUCTION

From last few decades there is a large migration of people in metro cities in search of better job opportunities (specially women workforce). At present couples who both are working may find it difficult to give proper time and care to their baby. In corona times many people were working from home and it was difficult for them to balance workload and parenting, This put extra burden on parent, Situation aggravates when baby is ill where it require a constant monitoring which results in taking leave from works. This not only affect the career of parent but also put a stress on them so there is a need to reduce burden of monitoring and nurturing on parents. Our project is an innovative idea to resolve this problem by developing an automated smart cradle system using IOT to monitor and nurture child in an efficient way. We ought to create an IOT based smart cradle system to assist parent in monitoring of their child regardless of their presence whether they are at work or in home. This cradle system is equipped with an automated swing mechanism which will swing automatically on detection of baby crying sound also it has an certain time limit to send an notification to parent if baby don't stop crying, Along with it

has an wetness detector to detect the wetness of mattress and send SMS to parent's phone. A camera is attached at top of the cradle so that parent can have continuous surveillance on their baby while they are at work. This cradle also has an automatic toy for baby's entertainment which will reduce the possibility of baby crying

LITERATURE REVIEW

Marie R. Harper and Maxine R. Blea developed the first automatic rocking cradle which swings side by side on a horizontal axis which replicate the motion same as achieved by human oscillation of cradle. Spring motors are used to provide oscillatory motion to crib. Springs motors are attached to the crib of cradle that produce motion same as human efforts. The spring motor is of any known type in which the gear –operating means is easily stopped when the slightest resistance or opposition to its movement is encountered, thereby providing on extremely safe device for use with small children or babies. The advantages of this system is cost effectiveness, safe for small babies as it has mechanism to stop swinging of crib whenever a resistance is occurred, require less human efforts and presence. The limitation of this system is it does not support video monitoring [1]. Yang HU developed an algorithm to control the speed of motors based on the parameters obtained from baby monitoring this model help the user to control the speed of swinging on pattern of intensity of baby crying. [2]. In [3] authors have designed a cradle system with an android app to monitor baby, which swings automatically after detection of baby crying sound. The principle behind this mechanism is that a sound sensor detect sound made by baby during crying and compare it to Preset value in microcontroller if sound made by baby is greater than preset value a signal is generated by. In [4] authors have used a Gas sensor (MQ-135), Temperature sensor (LM-35), sound sensor (KY-038) and a cloud server to integrated it with Raspberry pi in order to upgrade the conventional cradle system to meet the needs of parents. The three sensors records the data collected from baby body parameters and all the information taken from sensors is stored in cloud which keep on sending SMS to parent regarding baby parameters at regular interval of time. This system is user friendly as it requires less hardware components and cost effective.

EXISTING METHOD

In recent decades, a significant migration of people, especially women, has been observed in metro cities in search of better job opportunities. In many cases, both parents are working, making it challenging to give adequate time and care to their baby. The situation becomes more complicated when, during events like the COVID-19 pandemic, parents are required to work from home. This often results in a difficult balancing act between managing work responsibilities and tending to their child's needs.One of the main issues faced by working parents is the difficulty of providing constant care and attention when a child is sick or needs round-the-clock monitoring. This not only affects their career but also creates emotional and physical stress. Thus, there is a pressing need to reduce the burden of child care by leveraging technology to assist parents in the monitoring and nurturing of their child.Our project addresses this issue by proposing an IoT-based Smart Cradle System designed to assist parents in monitoring and nurturing their child efficiently, even when they are not physically present at home. This system uses a combination of automated mechanisms and sensors to reduce the caregiving burden while ensuring the baby's well-being.

Automated Swing Mechanism:

The cradle is equipped with an automated swing function that activates upon detecting the baby crying.

Using a microphone and sound detection algorithm, the cradle can automatically swing to soothe the baby. If the crying persists for a set period, the system sends an alert to the parents.

Crying Detection and Notification System:

If the baby continues crying beyond a specified duration, the cradle will send an instant notification to the parent's phone. This notification alerts the parent about the baby's discomfort, enabling them to take action if necessary**..**

Wetness Detection Sensor:

A sensor is incorporated into the cradle's mattress to detect wetness or soiling. When the sensor identifies that the baby's diaper needs changing, it automatically sends an SMS or app notification to the parent's phone. This helps ensure that the child's hygiene needs are promptly addressedLimited Scalability

Automated Toy for Entertainment;

The cradle includes an integrated automatic toy system that can engage the baby and reduce the likelihood of crying. This toy can be activated remotely, providing entertainment or distraction for the baby, which in turn might calm them down.

Real-Time Surveillance via Camera:

A camera is mounted at the top of the cradle to provide continuous live surveillance of the baby. Parents can monitor their child remotely via a smartphone application, whether they are at work or elsewhere.

PROPOSED SOLUTION

The net framework of the proposed project is to break up the above block chain by developing a smart electronic cradle to convoke all the data to assist the baby and to bridge the gap between the parents and the infant. Our product uses a mechanism where in the cradle is designed to swing in side by side direction preventing the infant from Shaken Baby Syndrome. The main objective of our project is to bridge the gap between the children and parents who are far away from the infant. The various sensors attached to this cradle system will keep monitoring the activities of the baby, that the cradle system will swing the cradle automatically that there is no need for any manpower to swing. If problem is caused then parents are intimated by sending the notification to their mobile via blynk app, proposed system will decrease the difficulty of these hurdle, and release the stress of parent and the most importantly baby will safe, healthier and he will sleep without any discomfort.

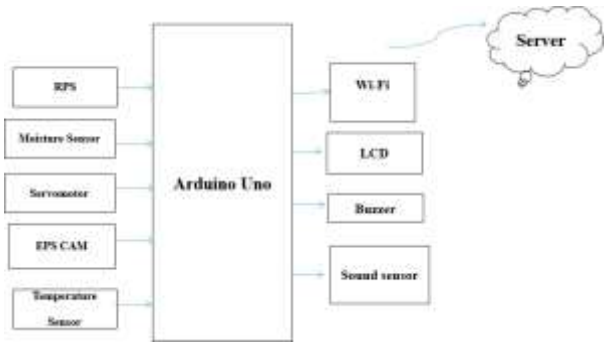


Fig.4.1.1: Block Diagram

HARDWARE COMPONENTS

Arduino UNO

This is an open-source Microcontroller ATmega328P with a total of 28 pins but 20 pins can only be programmable divided into 14 Digital pins and 6 Analog pins. We are using ARDUIO IDE for programming with USB Cable.

Moisture Sensor

Baby's wetness can be identified by wet sensor. A wet sensor continuously keeps on checking whether the baby's mattress is wet or not. When the wetness is sensed then parents are intimated by sending message through blynk app. This system helps in keeping the baby in a Hygienic environment.

GSM Module

A GSM module is a a hardware device that uses GSM mobile telephone technology to provide a data link to a remote network. From the view of the mobile phone network, they are essentially identical to an ordinary mobile phone, including the need for a SIM to identify themselves to the network. GSM modems typically provide TTL- level serial interfaces to their host. They are usually used as part of an embedded system.

Servo Motor

A servo motor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servo motors

Condenser Microphone

A condenser microphone is an active transducer that converts sound waves (mechanical wave energy) into audio signals (electrical energy) via the movement of a diaphragm in a fixed-charge capacitor-based capsule and electrostatic principles

Wifi Camera

A Wireless cameras work by transmitting the camera's video through a radio (RF) transmitter. The video is sent to a receiver that is connected to a built-in storage device or through cloud storage. Through your monitor or receiver, you'll have an easy link to access all of your image or video clips.

Led

It is a light emitting diode which emits light by applying voltage. In our project we using this component to represent the Lights present in the railway station.

Buzzer

It generates sound by vibration of piezoelectric element by applying electricity. In our project we are using this as high alert indication for critical conditions.

Adapter

It's a 12V adapter used as a power supply which converts alternating current into direct current. We are connecting this from wall outlet.

SOFTWARE

Installation of ARDUINO

Step-1: Download And Extract Arduino IDE Software.

Step-2: Launch Arduino IDE, Open the Arduino IDE from the desktop icon click next to install then click on icon to open the software.

ARDUINO Code Dumping

Step-1: Open your first project.

Step-2: Select your Arduino board then, Go to Tools > Arduino nano Boards > Boards Manager.

Step-3: Select your Arduino board Processor then, Go to Tools > Processor > ATmega328P.

Step-4: Edit Code on Editor Window then, Click on File tab and then open preferences.

Step-5: Compile code.

Step-6: Upload Code into Arduino Board.

ADVANTAGES

Remote Monitoring:

You can check on your baby from anywhere using your smartphone. This is great for when you're in another room or even away from home.

Automated Soothing:

The cradle can automatically rock or play soothing sounds when it detects your baby crying.

Data Tracking:

The cradle can track your baby's sleep patterns, temperature, and even breathing.

This data can help you identify any potential problems and share it with your pediatrician.

Safety Features:

Some smart cradles have sensors that detect if the baby has rolled over or if the temperature is too hot or cold.

You'll receive alerts on your phone if anything is amiss.

Convenience:

It saves you from constantly having to go check on the baby, letting you do other things.

It helps to provide a more consistent and controlled enviroment for the baby.

Reduced Stress:

Knowing that you can monitor your baby remotely and that the cradle can automatically soothe them can reduce your stress levels.

APPLICATIONS

Vital Signs Monitoring:

- Sensors can track the baby's heart rate, breathing patterns, and temperature, providing real-time data to caregivers.
- This allows for early detection of any irregularities or potential health concerns.

Environmental Monitoring:

- Sensors can measure temperature and humidity within the cradle's environment, ensuring optimal comfort for the baby.
- This helps prevent overheating or discomfort due to unfavorable environmental conditions.

Motion and Sound Detection:

- Motion sensors can detect the baby's movements, alerting caregivers to any unusual activity.
- Sound sensors can detect crying or other noises, enabling parents to respond promptly.

Live Video Streaming:

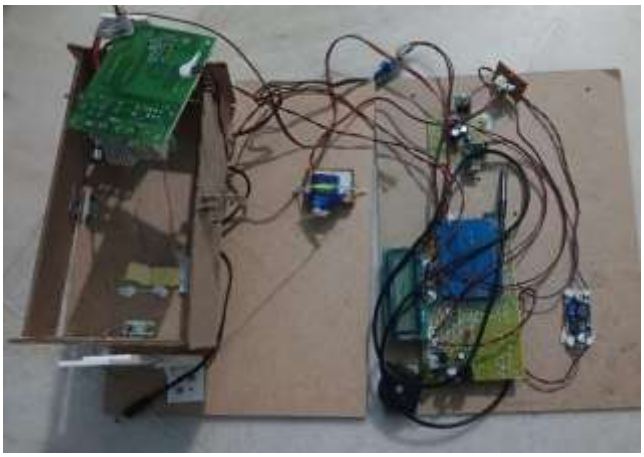
- Integrated cameras provide a live video feed of the baby, allowing parents to visually monitor their child remotely.

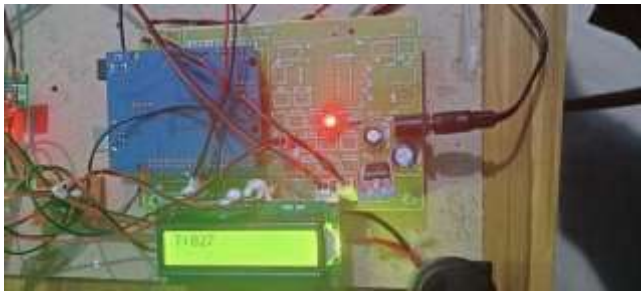
EXPERIMENTAL RESULTS

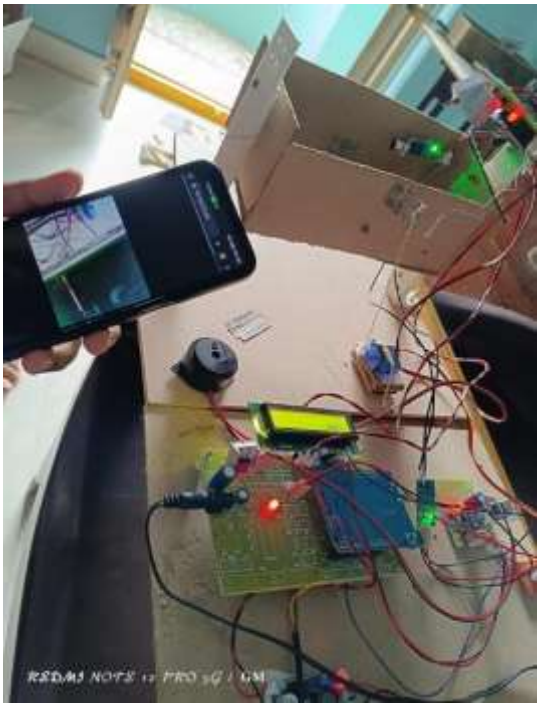
A smart cradle, powered by IoT technology, offers a range of Features designed to enhance infant care and provide peace of mind to parents.

Here are some key expected outputs from such a system:

- Baby's Vital Signs(Body temperature)
- Movement Detection: (Detects if the baby is moving or still)
- Sound Detection: (Detects baby's cries or other sounds, Sends alerts to parents' smartphones)
- Night Vision Camera: (Provides live video feed of the baby, even in low-light conditions)
- Server: (Real-time monitoring of baby's status)







FUTURE SCOPE

The Railway Interference Alert Management System (RIAMS) may be improved in the future through the integration of cutting-edge sensor technologies, the investigation of autonomous capabilities, and the integration with intelligent infrastructure. Additional important areas for improvement include enhancing communication protocols, dynamically adapting replies, and maximizing energy efficiency. The RIAMS will go even further toward safer and more effective railway operations through standardization efforts, user interface improvements, and international collaboration projects.

Enhanced Health Monitoring:

Future cradles could incorporate more sophisticated sensors for continuous, non-invasive monitoring of:

- Blood oxygen levels.
- Detailed sleep analysis (including REM cycles).

- Early detection of potential health issues like apnea or respiratory infections.
- Integration of wearable sensor technology that syncs with the cradle data.

Improved Automation and Comfort:

- Cradles could learn the baby's preferences and automatically adjust rocking motions, lullabies, and environmental settings.
- AI could refine these adjustments based on the baby's real-time responses.
- Integration of advanced climate control systems to maintain precise temperature and humidity levels.
- Development of smart textiles that adapt to the baby's body temperature.

Enhanced Safety and Security:

- Improved sensors and mechanisms to prevent falls and ensure the baby's safety.
- Integration of facial recognition or other biometric technologies to ensure only authorized individuals can access the cradle's controls.
- Seamless integration with home security systems to provide comprehensive monitoring and alerts.

CONCLUSION

In conclusion, the integration of IoT into smart cradles represents a significant leap forward in infant care, offering a blend of enhanced safety, convenience, and data-driven insights. By leveraging real-time monitoring of vital signs, environmental conditions, and movement, these devices empower parents with a greater sense of security and enable proactive responses to their baby's needs. Automated features like rocking and lullaby playback contribute to a more soothing and comfortable environment, while mobile app integration and personalized alerts ensure constant connectivity and timely notifications. As technology continues to advance, the future scope for smart cradles holds immense potential, with possibilities for advanced health monitoring, adaptive learning, and seamless integration with smart home ecosystems. Ultimately, the development of these intelligent cradles aims to create a more supportive and informed parenting experience, fostering healthier and happier beginnings for infants.

The power of IoT technology, revolutionizes the way we care for infants. By integrating sensors, Wi-Fi connectivity, and a user-friendly mobile app, this innovative system provides real-time monitoring of a baby's vital signs, sleep patterns, and environmental conditions. The Smart Cradle's alerts and notifications enable parents to respond promptly to their child's needs, ensuring a safe and nurturing environment. With its potential to reduce SIDS risk, promote healthy development, and alleviate parental anxiety, the Smart Cradle is poised to transform the future of infant care.

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