Smart Baby Cradle

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Abstract: **The cradle is a device that is used to put babies to sleep. cradle has a side-to-side rocking motion that eases the baby and put it to sleep. it takes a lot of efforts from parent to physically rock the cradle to generate swinging motion. when baby is kept inside the cradle needs to be constantly monitoring parent to keep to track of the baby's activity. the proposed idea in this prototype of smart cradle will allow the cradle to efficiently integrate itself with a smartphone typically an android device. An Arduino microcontroller will be used to assemble all the sensors and hardware component required. constant monitoring of the baby inside the cradle will be done. if any activity such as urination or baby waking up from sleep occurs a notification through a Short Message Service (SMS) will be sent to the parent's device. the smart cradle will also have additional features such as rocking the baby automatically via geared motor mechanism. also, with some additional features such as watching the baby live through Arduino camera.**

Keywords: **smart baby cradle.**

1. Introduction

In the past few decades there has been a significant rise to the number of female participations in force industrialization. Due to which taking care of infant has now become challenge for such females. Such females need to rely on third person to take care of the baby. If a system is developed that can help parents to keep an update about baby during illness or even during normal routine, can be great help to such families as they can worry less about the baby and concentrate on work challenges. The other advantage is that alert messages will be issued on occurrence of any activity that is abnormal and detected by sensors. Communication will be done by Global system module (GSM) interface in which short messaging services (SMS) is an integral part. In this way we can keep track of some biomedical parameters of the infant.

A cradle is meant to provide comfort to the baby while sleeping. Hence, we carefully looked for options that come with a comfortable mattress and provide enough space for the baby to move. You can pick any of the options and ensure sound sleep for your baby. Safety is another top priority when selecting a cradle. The smart cradle incorporates the use of sensor for monitoring the movement of the child; Noise sensor for the detection of the child's crying activity and swings the cradle to soothe the child. There are various health care and health management system designed to look after health of adults and aged person. They can monitor various health status, automatically send alerts and have many other features. But this system cannot be practically put under practice for infants as they need to be used under caution. Unlike adults, infants require a completely different approach to healthcare as they are totally dependent on their parents. Infants cannot give feedback about health condition as their only way to express discomfort is by crying.

Hence a specially designed healthcare system is needed to take care of the infants. It would gradually decrease burden over parents especially mothers. In support to above theory authors have developed system which is based on commercial gem network. Vital baby parameters such as body temperature using lm35 sensor, heart rate using ire transmitter and receiver, respiratory rate by using piezo sensor located on patient's chest are sensed, filtered and given to microcontroller. A wet sensor to detect urine condition in the cradle and all other data is given to microcontroller. Authors also proposed an idea of mounting a camera on the cradle, so the parents can get live images of the infant inside the cradle when they are away.

A speaker communication system to help calm the baby by hearing the parent's voice. Also, a mobile toy over the baby sleeping area to ease the baby. A remote subsystem with GSM module receives data and sends it to microcontroller for processing.

2. System Overview

The proposed prototype of smart baby cradle will monitor the activities of the infant. The cradle has motor which will rotate the smart phone 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 camera will be used to track the baby inside the crib. A GSM module to communicate with a remote device that is operated by parents. And an Arduino microcontroller to control and monitor the activities of the cradle.

Arduino Uno: It is a microcontroller board developed by Arduino.cc and is based on Atmega328p Microcontroller. The first Arduino project was started in Interaction Design Institute Ivrea in 2003 by David Cuartillas and Massimo Bansi with the intention of providing a cheap and flexible way for students and professionals to learn embedded programming.
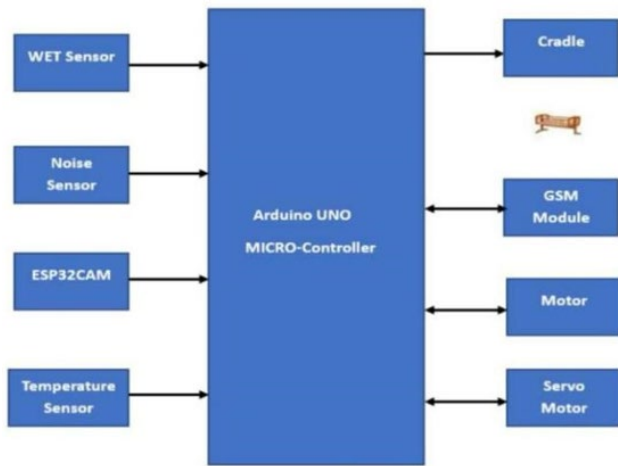
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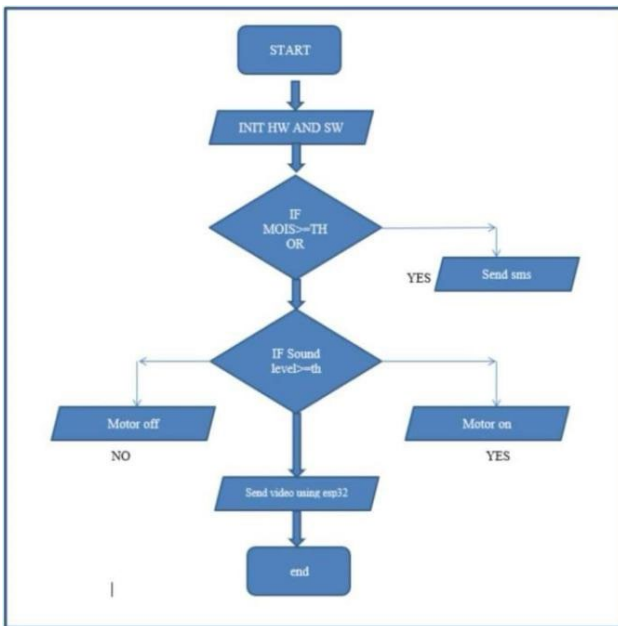
Fig. 1. Block diagram

Fig. 2. Flowchart

A. Technical Specifications

The Arduino uno development board is based on the Atmel atmega328, an 8-bit, 16 MHz microcontroller with 14 digital Input/Output (I/o) pins, 6 of which are capable of Pulse-Width Modulation (PWW), as well as a 6-channel, 10-bit Analog To-Digital converter. (ADC) digital communication capabilities include art title serial, sip serial, and two-wire interface serial (i2c). the Arduino development platform features a cross-platform, java-based ide as well as a c/c++ library which offers high-level access to hardware functions.

The major features of micro controller atmega328p: High performance, low power atmel®avr® 8-bit microcontroller family.

1) Advanced risk architecture
- 131 powerful instructions
- 32 x 8 general purpose working registers
- fully static operation
- up to 20 mips throughput at 20mhz
- on-chip 2-cycle multiplier

- High endurance non-volatile memory segments
- 32kbytes of in-system self-programmable flash program
- Memory
- 1kbytes eeprom
- 2kbytes internal ram
- 2KBytes Internal SRAM

2) ESP32CAM

The ESP32-CAM is a full-featured microcontroller that also has an integrated video camera and microSD card socket. It's inexpensive and easy to use, and is perfect for IoT devices requiring a camera with advanced functions like image tracking and recognition the sample software distributed by Espresso includes a sketch that allows you to build a web-based camera with a sophisticated control panel. After you get the hang of programming the device, you'll find that it is very easy to use.

3) GSM: Sim800

GSM (Global System for Mobile Communications) used for the transmitting and receiving of messages. The module is as follows:

Sim800 is a miniature cellular module which allows for General Packet Radio Service (GPRS) transmission, sending and receiving SMS and making and receiving voice calls. Low cost and small footprint and quad band frequency support make this module perfect solution for any project that require long range connectivity. EDS18B20

4) Temperature sensor

The Dallas temperature sensor is a 1-wire programmable temperature sensor from maxim integrated. It is widely used to measure temperature in hard environments like in chemical solutions, mines, or soil etc. The constriction of the sensor is rugged and can be purchased with a waterproof option making the mounting process easy. It can measure a wide range of temperature from -55°c to +125° with a decent accuracy of ±5°c. Each sensor has a unique address and requires only one pin of the much to transfer data so it a very good choice for measuring temperature at multiple points without compromising much of your digital pins on the microcontroller.

5) Moisture Sensor

Moisture sensors measure the volumetric water content in wet. Since the direct gravimetric measurement of free-wet moisture requires removing, drying, and weighing of a sample, wet moisture sensors measure the volumetric water content indirectly by using some other property of the wet, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

6) Servo motor

The servo motor as assembly of 4 things: a traditional dc motor, a gear reduction unit, a unit device and a bearing circuit. The dc motor as connected with a gear mechanism which provides feedback to a past sensor which as mostly a mostly. From the gear box, the output of the motor as delivered via serve spine to the serve Sound Sensor:

A sound sensor is defined as a module that detects sound waves through their intensity and converts it to electrical signals. The sound detection sensor module for Arduino detects whether the sound has exceeded a threshold value. Sound is

detected via microphone and fed into an

7) LM393 op-amp

The sound level set point is adjusted via an onboard potentiometer. When the sound level exceeds the set point, an LED on the module is illuminated and the output is sent low.

3. Result

The outcomes we anticipate getting from this study are as follows:

1) Innovation has been created incredibly that it makes human work less complex.
2) The program supports is the best answer for the present guardians who can't allocate adequate time of their children.

4. Applications

1) *Activity Monitoring:* This cradle is equipped with sensors and cameras to monitor all the activities of the baby while in the cradle.
2) *Maternity Hospital Use:* It can be used in maternity hospitals to care for multiple babies, particularly when there is a limited number of hospital staff available to look after each baby individually.
3) *Working Parents:* This technology is beneficial for parents who are both working, as it allows them to keep an eye on their baby's activities remotely.
4) *Metropolitan Households:* In urban households with limited space, the compact design of the cradle makes it suitable, and parents can easily monitor their baby from nearby.
5) *Reduced Risk:* The cradle helps in reducing risks associated with baby care by providing real-time monitoring and alerts.
6) *Activity Alerts:* The cradle is capable of sending SMS alerts to parents for various baby activities, including crying, changes in urine, and when the baby wakes up from sleep.
7) *Day Care Centers:* This technology can also be used in day care centers to enhance baby care and provide real-time information to caregivers.
8) In maternity hospitals, where the demand for baby care often surpasses the available staff, this smart baby cradle becomes an invaluable aid in tending to numerous babies simultaneously. Similarly, for working parents, the cradle offers a lifeline, allowing them to keep a close watch on their baby's activities from their workplace.
9) In metropolitan households, where living spaces can be constrained, the cradle's compact design ensures parents are always within reach of their infant. Beyond convenience, this technology significantly reduces the risks associated with infant care. It can send real-time SMS alerts for various baby activities, from crying and changes in urine to waking up from sleep.
10) Moreover, its potential extends to daycare centers, where it enhances the quality of baby care and provides caregivers with invaluable real-time insights into each infant's well-being. This innovative cradle is a versatile solution, offering enhanced care and monitoring for infants in a wide array of settings.

5. Conclusion

The proposed idea of smart cradle is a less expensive and easy to use system. It can help improve the quality of infant care system. This system will provide parent's assurance that their infants is well taken care of. The constant capturing and monitoring of various biomedical parameters of the baby helps the mother to understand baby's internal health status. As GSM technology is used it makes the user communicate for longer distance. It is a convenient system to monitor the baby health care from any distance.

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