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Iot-Based Smart Cradle Monitoring System for Newborns

Devesh Pratap Singh[1], Durgaprasad Gangodkar[2], Dibyahash Bordoloi[3]

[1]Department of Computer Science & Engineering,Graphic Era Deemed to be University, Dehradun, Uttarakhand India, 248002
[2]Department of Computer Science & Engineering,Graphic Era Deemed to be University, Dehradun, Uttarakhand India, 248002
[3]Head of the Department Department of Computer Science & Engineering,Graphic Era Deemed to be University, Dehradun, Uttarakhand India, 248002

ABSTRACT

The Internet of Things has gained popularity due to the widespread use of mobile phones and the availability of high-speed internet. The usage of mobile phones by parents who are employed outside the home as a means of monitoring their children's activities while the children are in the care of others is a significant example of this trend. Within the scope of this article, the design of the Smart Cradle that allows for such video monitoring is presented. The moment this cradle detects the sound of a baby crying, it will begin to swing. Additionally, it will sound a buzzer and send an alert to your phone if either of the following conditions are met: first, the baby cries for longer than a predetermined amount of time, which indicates that the cradle is unable to care for the baby and that the baby requires personal attention; second, the mattress in the cradle is soaked. This cradle features an automatic toy that rotates around to keep the baby entertained, which will lessen the likelihood that the baby will cry.

Keywords:

INTRODUCTION

The modern way of living is quite fast-paced. The majority of working parents acknowledge that it can be challenging to juggle the demands of work and child care. They are unable to monitor their child at all times, and it is difficult for them to do so after long hours at work. It's probable that in this scenario, rocking the infant in a cradle by hand won't be an option for easing their discomfort. Even if they have enlisted the assistance of a babysitter to complete the task, concerns for the baby's safety will continue to occupy their minds. As a result, there is a demand for a product that can close the communication gap between parents and infants. It is advocated that these parents be given assistance in the form of a cradle system so that they can properly care for their child. The following are the components that make up this cradle system.

1. When the cradle detects the sound of a newborn crying, the swinging motion begins automatically.

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2. If the infant does not cease crying after a predetermined amount of time, an alarm will sound and an alert will be sent to the parent's smartphone.

3. If the mattress becomes wet, an alarm will sound and an alert will be sent.

The bed wet alert is helpful in maintaining a clean and safe environment near the infant, and the second alarm is helpful in providing attention to the baby whenever it is required. [10] With the assistance of an application, the aforementioned data might be sent to an Android smartphone by way of a cloud server. The advantage of receiving such an alert is that it enables the parent to learn about the status of the kid regardless of where they are or what time it is thanks to the internet.

LITERATURE SURVEY

The current smart health monitoring system relies on Android mobile phones and is built in such a way that raw data is obtained from wearable sensors and then sent on to the microcontroller for processing. After that, the output is wirelessly transmitted to an Android smart phone utilising Bluetooth technology. Some of the existing health monitoring systems will send a notification to the user's mobile phone in the form of an SMS message by utilising a GSM module.

Harper et al is credited with inventing the first cradle that could automatically rock and was completely safe for infants. The spring-loaded motor was utilised to provide oscillatory motion that rocked the cradle in a manner similar to how a mother would manually rock the infant.

In addition, the traditional crib is outfitted with the electrical gadget, and the rocking motion is achieved through the use of electronic controls. It includes a sensitivity adjustment so that the sound of a baby crying that is picked up by the microphone can trigger the rocking action for a certain amount of time using the timer proposed by ***Gim et al***.

In later years, a device that could identify the sound of a baby crying was developed by ***Steven et al.*** An amplifier is used to amplify the sound signal, and a pulse generator circuit is used to produce the pulse signal once the sound signal has been amplified. This pulse signal is fed into a signal recognition circuit, which ultimately produces an output that indicates the detection of a newborn crying.

An automatic baby rocker proposed by ***Anritha et al*** that has a noise sensor to detect a baby's cry has been proposed. In this rocker, the sound signal that is inputted is amplified by the preamplifier, and then it is sent to an Arduino atmega328 microcontroller to operate the dc motor, which causes the rocker to move. A few bright LED lights are utilised in the rocker to keep the child entertained while they are being rocked.

Yang Hu et al has presented an algorithm for adjusting the amount that a crib rocks in response to signals from sensors. There are three pressure sensors utilized in the sensor network, one of which is positioned in the centre of the bassinet, with the other two located to the left and right of it. This allows the state of the baby to be determined. The swaying rhythm can be altered to accommodate the changing needs of the baby.

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PROPOSED METHODOLOGY

The following outlines the fundamental idea that underpins the automatic swinging cradle. The sound of a baby crying, which is measured in decibels X and compared to a value Y that has been preset. In order to determine the sound level X, the input signal, which is the sound of a baby crying, is first amplified and then transformed to a digital signal.

$$soundlevel = 20_{log}\left(\frac{v_{in}}{v_o}\right) DB$$

Where,

- ✓ When the infant is sobbing, the Vin value equals the voltage.
- ✓ V0 = the average voltage reference while the baby is in a peaceful state.

The value Y that has been established as the threshold might be regarded the value. It is possible to set it by selecting the value from the sample set of baby cries that is the lowest.

```
1.  Set Threshold(){
2.  THvalueS1       user input
3.  THvalueS2       user input
4.  ThvalueS3       user input
5.  Update_to_DB (V1, V2,
V3)6.       }
```

Algorithm 1:For setting threshold value

```
1.  Alert_Generation(){
2.  ScanValue(channelNo)  //Current Input Value
    //Scanning channel value
3.  For(i=0: total_channel){
4.  CurrentValue[i] =ScanValue
(i);5.        }
6.  For(i=0: total_channel){
7.  If(CurrentValue[i]> Thvalue[i]){
    //send command to hardware to start buzzer
8.  Start_buzzer();
9.  Start timer();
10. If t>5min{ Send_alert();}
11. Else{
12. Goto 3;
13. } }
```

Algorithm 2:Generating alert

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1. Check if video monitoring requested by client, iftrue then go to 2 else 7.
2. Check if camera is on, if true go to 3 else go to 4.
3. Display camera connection success message andgo to step 5.
4. Display camera connection error message and go to7.
5. Start video recording and send live feed throughcloud server to requesting client.
6. Repeat from 1.
7. Stop.

Algorithm 3:Remote monitoring

As can be seen in the algorithms presented above, algorithm 1 is the one that is used to set a preset value, which is then used to compare the input values from sensors to determine whether or not a condition for alert creation has been satisfied.

The second method takes the input value (also known as ScanValue) from a variety of sensors like the noise sensor and the moisture sensor, and then compares that value to the threshold value. In the case of the noise sensor, a higher ScanValue than the threshold value indicates that a baby crying sound has been detected, and in the case of the moisture sensor, it indicates that the bed mattress is wet. In such a scenario, the buzzer will be engaged, and an alarm will thereafter be sent to the android phone via the cloud server. Zigbee and RS-232 are both viable options for the communication link between the microcontroller and the cloud server.

A physical unit, a cloud server and database, and an android smartphone are the components that make up the Cradle system.

- ✓ The baby cradle is a type of bed for an infant that is attached to a motor so that it can rock back and forth.
- ✓ The cradle has a toy that rotates, and the toy will begin turning in response to the baby's cries or at the request of the parents. The baby's cries trigger the motor control unit, which then causes the cradle to rock back and forth. The device driver serves as the controller for both of the motors.
- ✓ Because of the Internet of Things, an alert can be issued to a smart phone based on whether or not the state is cry or wet.
- ✓ Cloud server: A cloud server functions in a manner analogous to that of a conventional server, except that users can have remote access to the services provided by a cloud service provider.
- ✓ Camera: For the purposes of video monitoring, a camera is installed in the vicinity of the cradle. It is constantly taking pictures with its camera. It is used to determine the state of the infant.Using an application and internet, a parent can perform video monitoring of their children.

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- ✓ The infant will be kept entertained by the rotating toy, which will also lessen the likelihood that the baby may cry. The majority of the time, the infant cries as they wake up from their slumber. When this occurs, a toy that rotates helps quiet a crying baby since it keeps the baby entertained. When a baby's cry is recognised, the toy immediately begins rotating, and it will continue doing so for the following five minutes. Additionally, the spin of the toy can be regulated according to the preferences of the user.

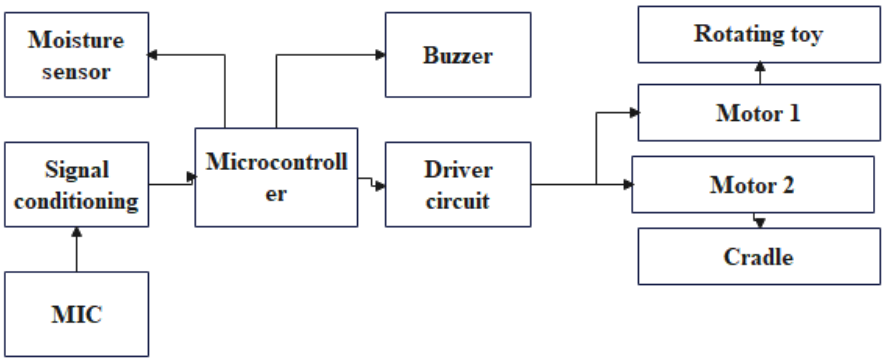

Fig 1: Proposed Architecture

The fundamental block diagram that centres on the AVR Atmega32 microcontroller is seen in Figure 1. The following building components make up the system:

- ✓ Noise Sensor: The noise sensor is responsible for determining the volume of the sound. When the infant cries in the bassinet, the sound is picked up by the microphone, which then transforms it into an electrical signal.
- ✓ Signal Conditioning: The process of amplifying an electrical signal is referred to as signal conditioning, and it is accomplished with the help of an op-amp. After the signal has been amplified, the microcontroller is able to use it.
- ✓ Moisture Sensor: The moisture sensor is made up of two leads that are arranged in a mesh pattern. While the other lead is connected to the microcontroller through a pull up resistor, one lead is connected to ground. When the baby wets the mattress, these two leads become short, and a signal is transmitted to the microcontroller. The microcontroller then sends the signal to the buzzer, which in turn alerts the parent.
- ✓ Buzzer: The buzzer will go off in the following scenarios: If the mattress in the cradle is moist, suggesting that it, along with the cloths, should be replaced. If the infant continues to cry after a certain amount of time, it is an indication that the baby requires attention
- ✓ Driver Circuit: The driver circuit is responsible for supplying the required amount of power to allow the cradle to revolve and for it to swing.
- ✓ Motor: Direct current (DC) motors are utilised in the rocking of the cradle as well as the rotating of the toy.

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RESULTS AND DISCUSSION

The investigation will focus on four infants at this point. The following scenarios are taken into consideration: Infants who are allowed to sleep in cradles that do not have toys or auto swing facilities Infants are being monitored while they sleep in a cradle that has a moving toy, an automatic swing, and other amenities.

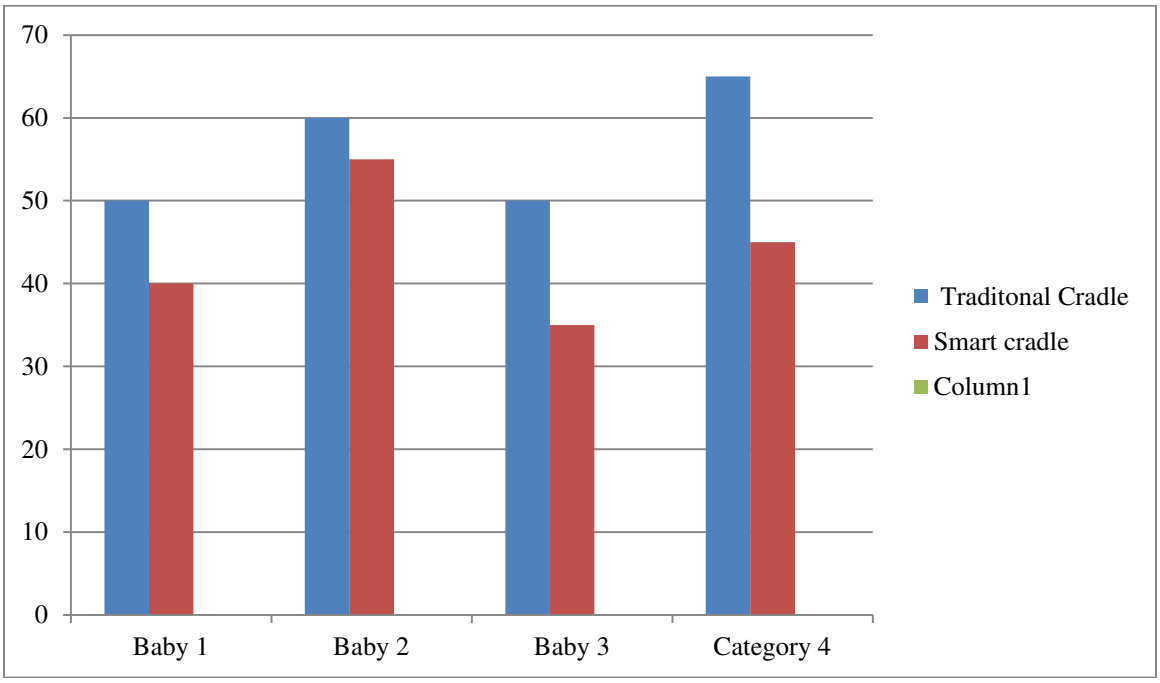

Fig 2: Compare and contrast the traditional cradle with the proposed cradle system.

The percentage of individuals who suffer from sleep disturbances can be shown in Figure 2.It has been noted that the baby receives increased attention with the assistance of the cradle's recommended design for a system. Additionally, it assures the safety of the baby by employing a baby sitter.

CONCLUSION

The care of infants is a challenging issue all over the world. Due to the fact that kids are our future, it is a very vital obligation. Even though a mother's lap is the ideal place for a baby to sleep, this system was developed in light of the realities of the modern world and an awareness of the value of newborn care. This method is both cost-effective and simple to use, which enables working parents to more easily handle their work responsibilities. Android phones, which are now the most popular choice for smart phones, now support video monitoring.This system may eventually be expanded to include additional functions, such as an infrared (IR) camera that provides night vision. Additionally, other client applications, such as those for iOS and other operating systems, are able to be developed for this system.

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