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An Innovative Design of Intelligent Cradle For Infants

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Abstract

Baby or a toddlers needs parent's attention 24 hours a day and 7 days a week, which is practically impossible due to other priorities like house hold activities, official works and personal works. Baby care centres or nanny are the two options available which involves lot of passion. Now a day's lot of incidents is reported in social media featuring human attack to the toddlers in a brutal way. So, there is a need for safe and secure place to take good care of the children's need with minimum human intervention.
The proposed system addresses all the above drawbacks in an efficient way. The novelty of the proposed system is that the parents can monitor the infant's activities, health condition and biological need of the baby even from a remote place. A semi-automated Intelligent Cradle is designed to eliminate the difficulties in baby care by ensuring Security, Comfort, and Entertainment with capability to monitor from a distance while the mother is busy with other work.

Keywords: Cradle, Intelligent system, Automatic control, Baby monitoring, Baby's cradle.

Introduction

The working women are highly tight up with office work and family management. The baby is a social creature from the get-go, they loves to be touched, mimic some of our gestures, talked to, cooded and smiled at, but recent statistics on working women indicate that 75% of mothers work full time in the first year of their child's life. They struggle to manage their baby while prepare themselves or others to do things. Especially women working-at-home are badly need some system to take care the baby while they work. Striking the right balance between work and home has always been a challenge for working women, particularly for motherhood. The survey in Hindu News paper titled 'Multi-tasking seriously affecting corporate women's health' found that 75 per cent of women employees had one or the other health problem, particularly due to the management of baby-at-Home and Work-at-Office.

Many working mothers dread the possibility of their child getting sick and need care during usual business hours. Most employers only provide paid sick leave for un-well employees that many working mothers have to take annual leave or unpaid leave in order to stay home and care for their sick children.

The dire need of mothers is Intelligent Cradle which provides comfortable safe stay to baby. The proposed system called "Intelligent Cradle" is designed with the aim of eliminate the difficulties in baby care by providing the intelligence to the cradle. It provides ability to cradle include; mechanical movement as cradle, to monitor the baby's health parameters, automatic temperature adjustment, reminder alert for hunger, medicine, wetness of the bed, monitoring through camera, Entertainment – Song (Lullaby Songs and delights in sound of our voice-record based),Colorful play Games, remote access.

Related Work

Steven Bang [1] designed automatic baby rocker having a noise sensor to detect baby cry, the Electric-mic in the sensor sense the noise (cry of the baby) with a pre amplifier (2n3904 transistor). Signal from noise sensor is fed to microcontroller Arduino ATmega 328, which is used to control the DC motor. Few colorful lights made up of LED are used to entertain the baby while being rocked. Mabuchi RE-260RA DC motor with Tamiya 6 speed gear box is used to create the rocking motion of the crib with gear ratio of 505.9:1. Yang Hu [2] proposed an algorithm for adjusting the bassinet swaying extent by the sensor signals. The bassinet is made up of an adaptive swaying device and other sensors network. While baby is crying, the sensors network can judge the reason according to detecting parameters, giving the different signals to control circuit. At the same time, the bassinet starts to sway slightly. The swaying rhythm can be adjusted according to parameters from baby status. They used three pressure sensor located in the bassinet bottom, one at the centre and others at left and right of the bottom. Marie R. [3] Harper invented a crib adapted to be rocked automatically. Once the crib is manually tilted in one direction and released, this permits the inertia to actuate the locking and actuating arms to operate under the biasing force of spring in conjunction with the gear. Thus spring loaded motor begin to operate and the lever arm is oscillated in back and forth movement. This provides the same effect as would be achieved by the mother rocking the crib containing the baby. Oscillation of crib is stopped when the slightest resistance is incurred.

Gim Wong [4] presented an Electronic device that can be attached to conventional pivotally mounted type crib. Which is actuated by baby cry voice picked up by the microphone giving short throw type rocking action to crib. Very similar to a person rocking the crib by pushing and pulling on the foot or headboard . There is a sensitivity control so that baby voice only actuate the rocking action and a timer to control the duration of rocking action. Chau-Kai-Hsieh [5] proposed a baby cry recognizer which includes an amplifier circuit for amplifying a received sound signal. In response to the amplified sound signal, a pulse generator circuit generates a pulse signal having zero crossings which are aligned with zero crossings of the amplified

sound signal. The pulse signal, in turn, is inputted to a signal recognition circuit. The signal recognition circuit outputs a signal indicating that a baby's cry was detected.

Anritha Ebenezer [6] gives an approach to design a baby cradle consisting of cry analyzing system which detects baby cry, According to sound intensity, the cradle swings. It has six rocks per minute. It has wet sensor to indicates baby wets, whenever baby wets resistance would change thus sending a signal.

Proposed Cradle Design

The proposed system "intelligent cradle" provides mechanical movements, baby health monitoring, temperature adjustment, urinary/potty alert, reminder, entertainment and remote control access. The proposed system is semi automated with partial human involvement. The aim of Intelligent Cradle is to eliminate the difficulties in baby care by providing the intelligence to the cradle. It has the following capabilities

1. Provides mechanical movement as cradle.
2. Provides the ability to monitor the baby's health parameters.
3. Provides automatic temperature adjustment of the room for comfortable stay of baby.
4. Provides an Alert on urinary/ potty of the baby.
5. Provides the Time alert for Hunger, Medicine.
6. Provides Monitoring system through camera
7. Provides Entertainment – Song (Lullaby Songs and delights in sound of our voice-record based),Colorful play Games.
8. Provides the remote access and monitoring through android based mobile phones.

Figure 1 describes the architecture design of the Intelligent Cradle. The sensors and interfaces are calibrating with the intelligent algorithms. The Intel Galileo based controller used as over all controller for the system.

A. Mechanical Movement Module – Cradle Swing

It provides mechanical movement as cradle with respect baby cry. The swing movement of the cradle is similar to pendulum movement [7] as the baby feels it as a real cradle. This module provides the option for choosing the speed of the movement and record option to record the activity of the baby at various speeds. When baby cries, microphone detects it and converts the sound signal into electrical signal, then the electrical signal is fed into amplifier for further enhancement and processing. The mechanical swing is achieved by the comparison of sound level of baby cry (C in dB) with a preset threshold value (P in dB). If sound level C is greater than P, then cradle will swing according to the intensity of C. The C can be determine as

$$C = 20\log_{10}\frac{Vin}{Vo}db$$

Where V_{in} is Voltage (ADC count) when baby is crying, V_0 is Average reference voltage (ADC count) when baby is not crying. The pre-set value P is set initially and can be re-configure at any time as and when necessary.

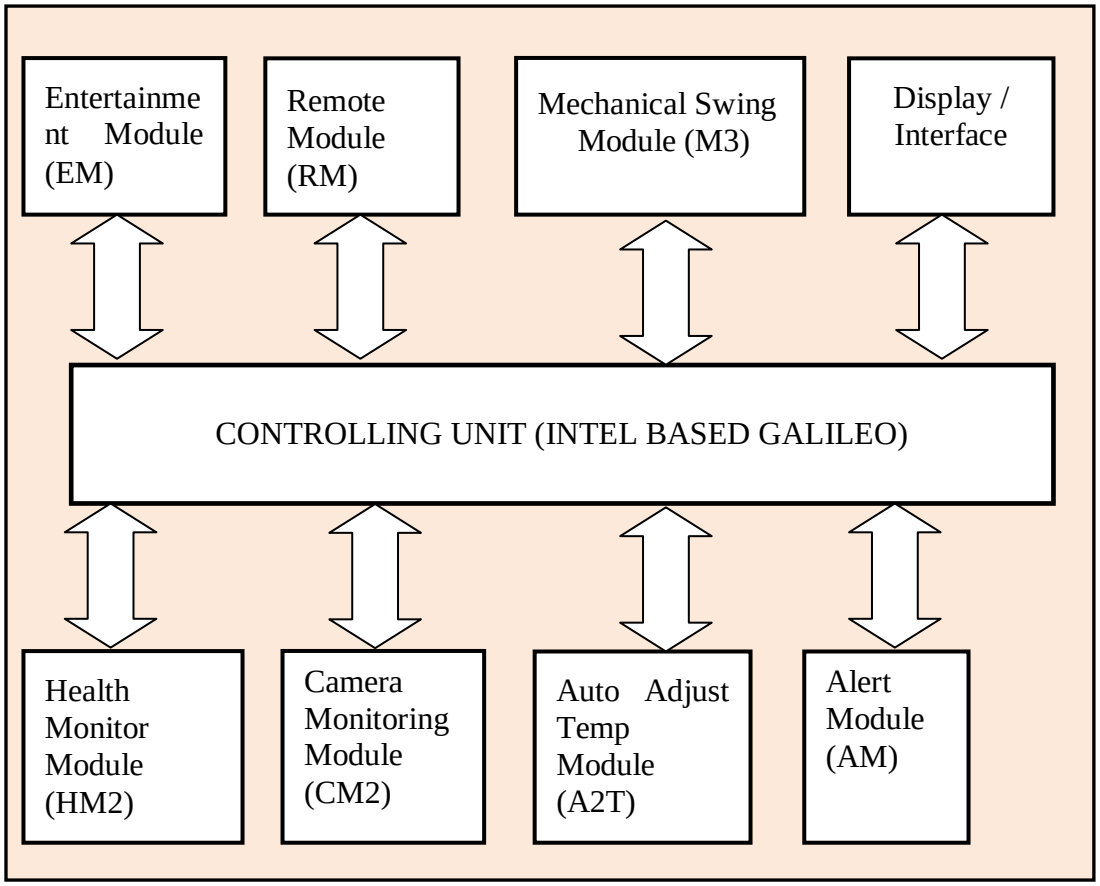

Figure 1: Architecture of Intelligent Cradle

B. Health Monitor Module

This module provides the ability to monitor the baby's health parameters. The health parameters such as temperature, Cold, Cough, and Nausea are being monitored by using various sensors of medical instruments[9]. Those medical instruments are enabled through the driver circuits. The image of baby can be recorded for monitor the health of the baby.

C. Auto Adjustment Temperature Module

This module provides Automatic-artificial temperature adjustment [8] for comfortable stay of baby. The temperature of the cradle environment is monitored continually fashion. The temperature sensor reads the temperature for every *'t'* seconds and adjusts the temperature after the comparison with preset threshold value.

D. Alert Module

This module provides the alert for urinary/potty of the baby, and gives the message to the parents to change the bed or cloth at right time, which is very much useful to protect the baby's health from bacterial infection or cold. These alerts are generated automatically based on the pre-loaded algorithms and the sensors inputs. This module also provides reminder for medicine (When the baby need to take medicine in the interval of time) and the time alerts for Hunger. These alerts are needed to load in advance as required. The alert module also provides the "Emergency Alerts" in case of any problem in the cradle.

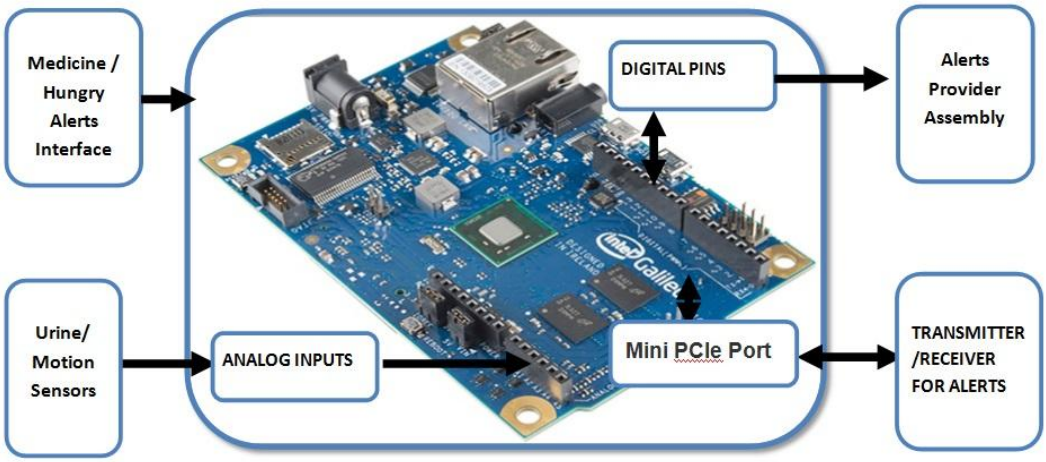

Figure 2: Integration of Interfaces For Alert

E. Camera Monitoring Module

The camera monitor module (CM2) provides the ability to monitor the baby from at remote places. The camera can be activated remotely. The proposed Android apps is used to access the baby monitoring over the mobile network. CM2 also provides the images of the baby with time stamp for Health monitoring and other purposes. The working principle of CM2 is that Web Camera is integrated with Intel Galileo processor through the necessary hardware/software integrators, and which can be accessed by the Android based Mobile Apps thorough Mobile Network. This module will be really useful to the Mother to feel the "Near By" touch moments and monitor the baby while in work.

F. Entertainment Module

The objective of this module is entertaining the baby by engaging baby to listen songs or play games. This module provides the entertainment kind of activities to the baby such as Lullaby Songs (Delights in sound of mother voice based record), Lighting games, simple movement Games, Makes Different Sound, Colorful play Games, etc. A special kind of assembly [10] attached with Cradle to provide the entertainment. It provides the record feature to record the mother voice based speech, Lullaby Songs, etc.,

G. Remote Module

The proposed android based Mobile App provides the ability to control the cradle remotely through mobile. This app gives access to the mother to monitor and control the cradle. The Android App is extended the remote access to remote places such as Office, Play ground, Swimming Pool, etc.

H. Display / Interface Module (DIM)

This module provides the Interface facilities such as Keyboard, other kind of the input devices, control option, Images, display unit, tablets, and display monitor.

Results

Each Module in the system is tested against various parameters. The feedback collected from different kinds of the working women after their usage of Intelligent Cradle. The results are encouraged. The Android based mobile app to access Intelligent Cradle remotely is more attracted.

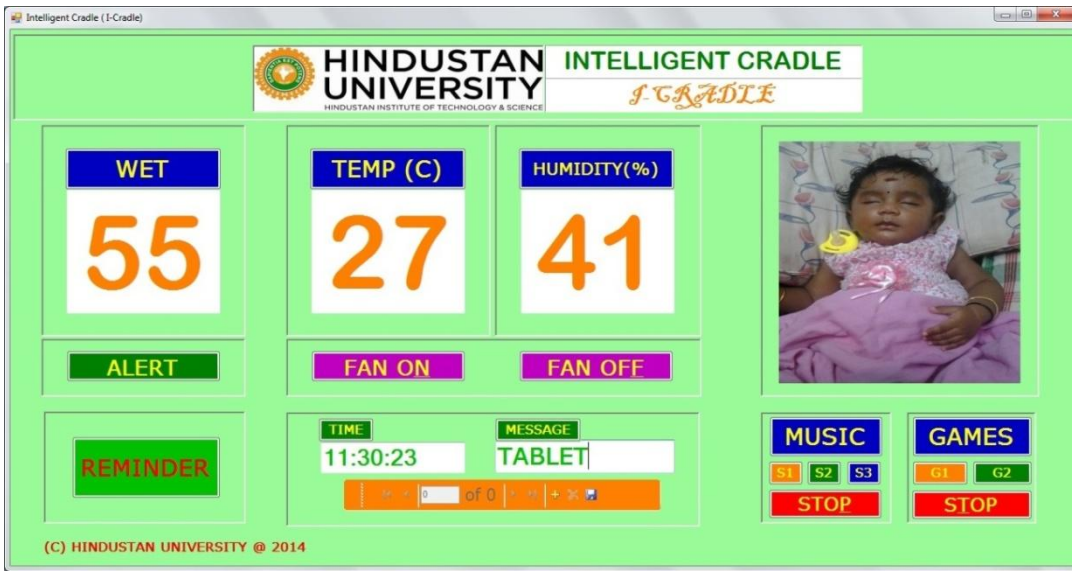

Figure 3: Remote Access Module For Intelligent Cradle

Operating the cradle through remote control is comfortable for old age peoples who are looking after the baby when the mother is at work place. The proposed model has secured a gold medal in the Intel embedded challenge 2014 organized by Intel.

Conclusion

The proposed intelligent cradle is affordable, portable, safe, fun, entertainment, compact enough for travel. It is light weight, snap to clean and operate. It gives mother peaceful in her work place and gives good sleep at night. Mother feels her

baby nearby in office and it provides safe, security, comfortableness, entertainment to the baby while the mother is busy with other work. It is expected to stop the women employees' resignation due to born baby. It is also expected to reduce the expenditure to baby care. The design of the proposed system will be enhanced with more features in future.

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