Journal of Harbin Engineering University
ISSN: 1006-7043

Vol 45 No. 3
March 2024

Green and Smart Baby Bassinet: An Innovation for Rural Working Mothers

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Abstract

Introduction Advances in technology have made life easier in a wide range for people who specially live in remote and rural areas. Particularly the rural and sub urban working mothers are increasingly dependent on new consumer electronics goods. In case of healthcare, the consumer electronics play an important role to bring technologically advanced products. In rural areas, frequent check-ups and availability of doctor for 24x7 hours are realistically a day-dream. This sparing medical facility also affects baby healthcare monitoring and in-time treatment. Moreover, the ever increasing working mother proportions also demand highly accurate baby care system. Conventional smart baby care system only alerts the working parents about the present status and any abnormality of baby's health but the system lacks telemedicine facility or online doctor consultation. Additionally the baby cradles are not user friendly in nature that creates many unwanted problems for working mothers.

Objectives The objective of this project is

1. To create a parent monitoring system over their infant when they are outside
2. To develop doctor-patient handling management system (e-Consultation) that helps patient not to visit clinics physically [9,10].

Methods: The cradle is furnished with an alarm system that generates sound in two conditions: first, pad that is essential for baby becomes wet and second, when the infant continues to cry for a prolonged time period, indicating baby's attention. Apart from these fundamental design criteria, the bassinet also has the ability to measure the temperature and amount of moisture around the baby, alerting the owner to the send the value via SMS or phone calls. The bassinet is fitted with a speaker so that rural areas people can easily understand that the bassinet is alerting them. The speaker system has multilingual feature that provides ease in understanding the baby bassinet's working protocol in their native language. Additionally the online doctor consultation facility provides proper medication in any abnormality of baby's health.

Results First the sound detection module check is their any sound or not. Before that set the threshold sound level as of the detector will detect the other sound around the cradle. Now, if it detect sound and if it is above threshold value then it will again check whether the detect value equals to high frequency value or low frequency value. If it is high then the servo motor is set on to swing the cradle and cradle song will start playing. If sound level is low then it send sms to parent as baby is cryinh because of feeling hungry, along with cradle music will play. After that if again baby is crying then it will start playing aniimated videos and sent alert message to parents and nanny through GSM module. Using YL-69 soil moisture sensor wetness around baby diaper is measured. PIR sensor detects the motion of baby in the cradle. Through OV7670 cam module, the parent can able to see them can able to interact with them. The online consulting system works on the registration and login of both the doctor and patient through app. The newly generated prescription get stored in cloud for future use.

Conclusions: The smart bassinet with an IoT baby monitoring system successfully monitors the critical parameters such as crying status, humidity, and ambient temperature. A smart baby crib has been designed and implemented based on several new technologies. The system helps parents during the day while they are busy and during the night while they are sleeping by swinging a cradle and playing cradle song.

Keywords: IoT, video conference system, online doctor consultancy, smart baby cradle, consumer electronics. Theranostic approach

1. Introduction

The current high rate of female labour force involvement in industrialized nations has an impact on baby care in many families. Because of the high expense of living, both parents must work. They still have to take care of their infants. Especially the mother is more sensible to her child and this sensitivity adds extra pressure to her workloads. The ever increasing pressure often creates stress to the mother that often creates shallow caring to her child. In this situation, both the parents hire a babysitter to watch the children while they are at work or send the children to their parents but grandparents are not very much effective to always monitor the infant's activities or any abnormalities arise. In conventional baby sitter, babies often sleep on soft surface or pillow that would be dangerous for them so firm surface is needed to protect babies during sleep. It has been observed that infants of 12 months or even 6 months older are more prone to Sudden Infant Death Syndrome (SIDS) that occurs due to sleeping in soft surface in conventional baby cradle. [1,2] Another aspect of SIDS is the temperature. During baby's sleep, the temperature should be within 25-27^{o}C but overheating may cause disturbance in baby's metabolism that can accelerate SIDS. Therefore the conventional baby cradle lacks a couple of technical discrepancies. [3] Another important parameter to promote SIDS is lack of indication of baby's movement or sleeping direction. Many babies are not steadily sleep rather they will move during their sleep that might be dangerous for them. These are some common constraints of conventional baby cradle. A major problem in rural areas is the lack of access to quality healthcare providers. Patients in desperate conditions are often referred to metropolitan hospitals by doctors who are not always available in rural hospitals. It is imperative that parents follow up with routine examinations following the birth of their kid. This would require the parents to travel great distances for examinations, which would be very challenging for them to accomplish when the child is with them. [4] In this scenario, remote sensing baby cradle with all possible types of monitoring is needed. Remote sensing baby cradle could be developed by incorporation of Internet of Things (IoT).

Internet of Things (IoT) implies to a network of objects (sensors) being connected to the internet. Thus IoT can process the sensor data on the Internet without any human intervention. The importance of IoT is increasingly drawing attention to world-wide researchers for making any system "SMART". [5,6] Astonishingly the IoT based system runs by the conventional battery that may be treated as not reusable and chemically rich energy sources. This constrain can be overcome by employing solar panel that will make the IoT based system "GREEN". So far received survey, limited investigations are conducted onto the development of fully automated baby cradle. Brangui *et al*. has proposed a baby monitoring system with excellent noise cancellation unit for baby's peaceful sleep and reduced sound pollution. The noise cancellation is accomplished with relaxing songs. The light sensor inbuilt in the system adjusted light intensity for making a peaceful environment but the system has no IoT enabled architecture and real time monitoring infrastructure.[7] Another report suggested an automatic swing E-baby cradle for detection of baby crying, that means when the baby will start crying, automatically swinging occurs and when the baby stops crying the swinging stops. The velocity of the swinging cradle is controlled based on the user's urgency. The inbuilt alarm monitors the abnormal conditions such as wetting of mattress, non stop crying of the baby. The only limitations of this proposed system is that parents should be near to the cradle system.[8] A similar automatic baby monitoring system was developed in [9] where the cradle swings when crying sound is detected, and the cradle stops swinging when the baby stops crying. The built-in alarm will OFF the mattress is wet or the baby does not stop crying after a certain period. The baby movement is monitored by a video camera positioned above the cradle. This system is challenged only be SMS reception by parents not any call. Another swinging based approach was developed by

Arduino inspired resonant cradle with infant cry recognition policy.[10] The system has been realized by a ball bearing architechture for elimination of system damping and facilitation of swinging without electricity. A sensor is installed to navigate the swinging status or angle. In this system, parents can record infant cries subjected to hunger or pain on an SD card, stored in an SD module. Unfortunately this system is constrained in distant mode operation when parents are far away from their baby although the system is IoT enabled because the system has no permission to update the lookup table in IoT server. Symon *et. al.* [11] devised a baby cradle based on Raspberry Pi and Pi camera. The designed system can navigate motion and crying condition of the baby. Condenser MIC was installed to identify and book the crying condition and PIR motion sensor to fix the baby movement with the help of Pi camera that will be turned ON only when baby crying will be generated. The limitation of this system is that parents can view from display of limited devices. Jabbar *et al.* have developed an IoT-BBMS for Smart Cradle that can measure the temperature. The readings will be displayed in the IBM Watson IoT Platform in graphical manner. Interestingly, the sensors can send the data to the IoT platform. Practically the system is not suitable for infants, because their bodies immune system is weaker than that of adults.[12] A A baby condition monitoring system based on GSM net work was developed by Patil *et. al.* [13]. In their devised prototype, infants pulse rate, body temperature, movement, and moisture condition are measured the information will be sent through GSM network. The sensing data will be captured by different sensors such as LCD screen, GSM interface, and buzzer, controlled by a PIC 18f4520 8-bit microcontroller. The LCD module displays the sensor output, and the GSM interface is responsible to send an SMS alert to the parents mobile number. The installation of large number of sensor circuits may cause baby touch with electrical components. Therefore the proposed system is scared by safety, cost, and user-friendliness. Saadatian *et al.* [14] proposed a mobile-based system that updates parents about the infants status. The system measures the temperature, motion, and heart rate following sending data to a server. Parents can receive the analyzed data and alert sign will be received only if any abnormality is found. An advisory aid-in information will be received by the parents for immediate action and nearest clinic will be notified by the system. The system utilizes Bluetooth for short range communication that becomes a major challenge for this prototype. Another aspect is that the system did not support IoT so remote monitoring is not possible

We now provide a Smart Baby Care system that has all the necessary qualifications for giving newborns the best care possible.[15] We presented an online medical consultation system integrated into the Smart Baby Bassinet in compliance with the concept. This system encourages physicians to handle online appointment scheduling. Any available spots during online appointment can be reserved online by patients. The scheduling data for numerous doctors on a variety of dates and hours is handled by the system. The doctor enters the patient's medical information into a database each time they see a patient. During their subsequent check-in, users can examine their whole medical history at any moment. This will facilitate the patient monitoring by the concerned doctor that would produce better comprehension about the patient's health. Another technology such as embedded system is empanelled here to instigate SMARTNESS in the present work. [16]

2. Objectives

The objective of this project is

1. To create a parent monitoring system over their infant when they are outside
2. To develop doctor-patient handling management system (e-Consultation) that helps patient not to visit clinics physically [17,18].

To achieve the above mentioned objectives, user friendliness of the system is necessary. To implement user- friendliness of the system for rural areas, voice assistant system in different languages is incorporated. This user compatibility helps the parents to make them understand what to do and what not to do. Apart from this, every entry and exit in physician e-clinic along with respective patient's medical data will be entered into a database by the physician. The dashboard is

accessible by the patients using log-in option and they can view their entire medical history at any time during their next check-in [19,20]. A sneak peek of the patient's medical history is accessible to the doctor and the patient gets the prescription online.

3. Methods

COMPONENTS REQUIRED

The proposed system is designed and implemented based on several new technologies modules that are both efficient and low cost. The modules and sensor are depicted below [7]:

a) Arduino Mega 2560
b) Arduino UNO R3
c) LMT85LPGM temperature and humidity Sensor
d) HC-SR505 Mini infrared PIR Sensor
e) Sound detector sensor
f) Bread Board
g) Mobile Phone
h) Orange Planetory DC 12v 970 RPM motor
i) Connecting Jumper wires
j) Resistors – 1k,2k,10k
k) OV7670 camera module
l) Ks0257TFT LCD 3.53" Touch Screen Display Shield
m) Solar panel
n) Fan
o) Alarm
p) 24V Battery
q) LM7824 IC 24V Voltage Regulator IC
r) Max30100 Pulse oximeter sensor
s) ESP8266 module
t) SIM900 GSM module
u) Speaker

FUNCTIONABILITIES OF MODULES AND SENSORS:

LMT85LPGM temperature and humidity Sensor

The LMT85 in Figure 1 is an accurate CMOS temperature sensor with a typical accuracy of 0.4°C (2.7°C maximum) and an inversely proportional linear analogue output voltage to temperature. The 1.8-V supply voltage, 5.4-A quiescent current, and 0.7-ms power-on time enable effective power-cycling architectures to minimise power consumption for battery-powered applications.

a] Algorithm for checking diaper wetness:

Step-1: Start the system.

Step-2: Keep checking if the baby's Diaper is Wet or Dry.

Step-3: If yes, notify the same to the parent (&babysitter) via message as well as ringing the alarm.

Step-4: It will ring the alarm and also send message to parents (&babysitter) that the baby's diaper is wet.

b] Algorithm for Temperature checking:

Step-1: Start the System.

Step-2: Keep checking the Temperature of Baby's surrounding in interval of given time period.

Step-3: It check whether temperature changes with given range of threshold temperature.

Step-4: If yes, then turn ON the fan

Step-5: It also sends temperature value to parents (&babysitter) as a message alert.

Step-6: Parents can also turn ON / OFF the fan using the Android Application.

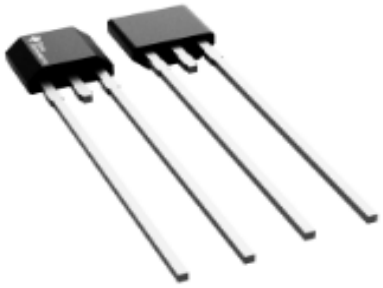


Figure 1. Temperature and Humidity sensor

HC-SR505 Mini infrared PIR Sensor

In this system, this sensor aids in the detection of motion. It decides if the infant is sleeping or not. An alarm message is provided to the parent if any odd activity is noticed. The sensor diagram is shown in Figure 2 below.

Algorithm for Motion detection:

Step-1: Start the System.

Step-2: Check if there is any movement in the bassinet.

Step-3: If motion is detected, then check if the movement occurred continuously or frequently.

Step-4: If motion detected continuously then message to parents (&nanny) that baby is not comfortable.

Step-5: Else motion detected frequently then message to parents (&nanny) that baby is sleeping.

Figure 2. PIR sensor

Sound Detector Sensor

This sensor, shown in Figure 3, aids in the detection of the baby's sobbing sound. It compares the baby's crying to a limit to decide whether he is crying since he is hungry or for other reasons. In case the infant shouts for an expanded period of time over the time restraint set up by the guardians, a notice will be sent to the guardians or nanny.

Algorithm for crying detection:

Step-1: Start the System.

Step-2: Check if there is any sound detected in the bassinet.

Step-3: If sound is detected, then check if the sound frequency is high or low compared to threshold frequency.

Step-4: If high then swing the bassinet at gentle speed and play lullaby song and start playing animated video on display.

Step-5: Else frequency is low then message to parents (&nanny) that baby feels hungry or need attention and play animated video on display.

Step-6: It also send message to parents if the baby is crying.

Figure 3. Sound detector sensor

Solar Panel

Sensor in Figure 4, is responsible for charging the battery. It will charge the battery using a voltage step up module. This will contribute to energy conservation.

Algorithm for piezoelectric sensor:

Step-1: Start the System.

Step-2: Check if the battery needs to charge or not.

Step-3: If it needs, then charge the battery by piezoelectric sensor.

Step-4: The amount of voltage generated pass through voltage booster

Step-5: Then it stored in battery

Figure 4: Solar Panel

OV7670 CAM Module

Figure 5 depicts a module that is used to keep an eye on the new-born via live video communication. In addition, this module is utilised to communicate with parents and nannies. Wi-Fi, Bluetooth, and a 2MP camera are all included in one module.

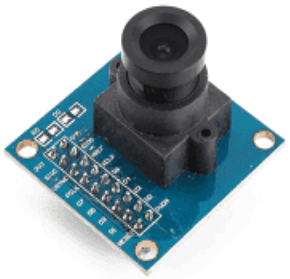


Figure 5: ESP32CAM Module

Max30100 Pulse Oximeter sensor

Figure 6 depicts a sensor solution that combines a pulse oximeter and a heart rate monitor. It's an optical sensor that uses a photodetector to measure the absorbance of pulsing blood after emitting two wavelengths of light from two LEDs, one red and one infrared.

Algorithm for piezoelectric sensor

Step-1: Start the System.

Step-2: Check baby pulse and Oximeter level.

Step-3: Then measured reading to parents through SMS alert system

Figure 6: Max30100 Pulse Oximeter sensor Module

SIM900 GSM module

Figure 7 depicts a GSM module, which is a circuit that allows mobile phones and microcontrollers to communicate. It sends SMS, MMS, and voice messages through a mobile network. The GSM module enables high data transmission rates.

Figure 7: SIM900 GSM module

Arduino UNO R3:

A removable, dual-inline-package (DIP), ATmega328 AVR microcontroller serves as the foundation of the Arduino Uno R3 microcontroller board shown in Figure 8. There are 20 pins for digital input and output of which 6 pins can be utilized as PWM outputs and 6 pins can be utilized as analog inputs. This will be modified utilizing the straight forward simple basic straightforward Synonyms Arduino computer program.

Figure 8: Arduino UNO R3

Arduino Mega 2560:

The microcontroller board from Figure 7., known as the Arduino Mega 2560 is shown in Figure 8. Based on the AT-mega 2560, I t has 54 digital I/O pins, 15 of which can be used as PWM Output and 16 analog input/output pins, 4 UARTs (hardware serial ports), 16MHz crystal oscillator, USB connector, power jack, ICSP header, and reset button.

Figure 9. Arduino Mega 2560

Ks0257 3.3-inch TFT LCD shield

Figure 10 shows a 3.3inch TFT LCD screen with the touch screen shown in Figure 12. key studio. This TFT display features 320x320 pixels with individual RGB pixel control, Equipped with ILI9325 chip. The display already has a resistive touchscreen, so it can detect finger presses anywhere on the screen. Also on the back is a reset button labelled K1 and a microSD card slot. (The microSD card is not included, but you can use any card.) This LCD shield is fully compatible with the Arduino UNO R3 and can be stacked on your board for easy use.

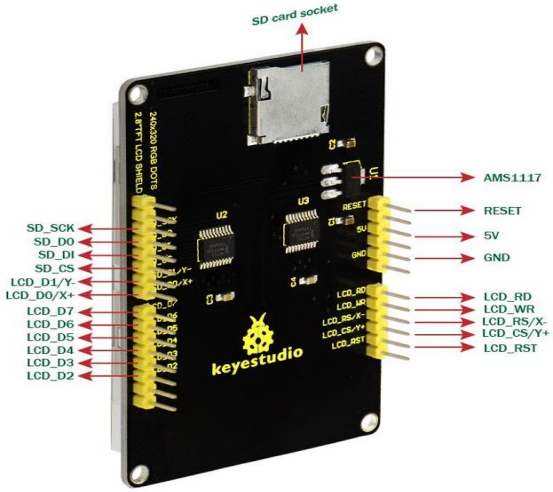


Figure 10: TFT LCD display shield pin configuration

Swinging system

When the Sound sensor crosses the threshold level, the bassinet Swing is activated. The standard DC Motor assists in swinging the bassinet.

Algorithm for bassinet swinging:

Step-1: Start the System.

Step-2: Check if the baby is crying or not.

Step-3: If yes, it triggers DC Motor which leads to swinging of the bassinet.

Step-4: It also sends the alert message for the same.

Step-5: Parents can also turn on / Off the bassinet swinging using the Android Application.

REQUIREMENTS FOR ONLINE DOCTOR CONSULTING

Software Requirements:

- Windows Xp, 7,10
- SQL (2008 or above)
- ThingSpeak IoT platform
- Visual studio (any version)

Hardware Components:

- Processor – minimum Dual Core
- Hard Disk – 50 GB
- Memory – minimum 1GB RAM

In the current study, we offer a system that enables users to access an intelligent health care system online and receive real-time health recommendations. The system receives information from a variety of symptoms as well as illnesses and diseases associated with those systems. If the system is unable to provide reliable results, it suggests that users have a blood test, x-ray, or any other report that it determines is relevant to their symptoms in order for them to upload a photo of that report when they check in again later. The uploaded photos are now being accepted, and a doctor login is now accessible on the system. Users can talk to the system about their problems and symptoms. Next, it examines the user's symptoms to determine whether any illnesses are associated with them. Modules:

- **Admin Login:** The system is overseen by the administrator, who also manages the reservations.
- **User login and registration:** Users must first register before they can log in. The user can view the availability of appointments by clicking on spaces.
- **Online appointment booking**: Users may make appointments for the desired time and date.
- **Automatic cost calculation**: The system computes the total fee for parking based on the user's chosen booking time.
- **Cancellation of reservations**: Users may cancel their reservations at any moment but before thirty minutes prior of the booking time by logging into the system.

Advantages of using online consulting system:

There is no need to visit a doctor's office.

- The user can discuss their disease and have live video interactions with doctors to obtain the necessary pharmaceutical prescription.
- Doctors can provide priority care in an emergency case until the patient can be brought to the hospital.

The user can look for doctor's help at any moment.

Disadvantage:

Everything has some disadvantage so like this online consulting is also having:

- At least one doctor must be online to assist the patient, and a huge database is required.

CIRCUIT DIAGRAM

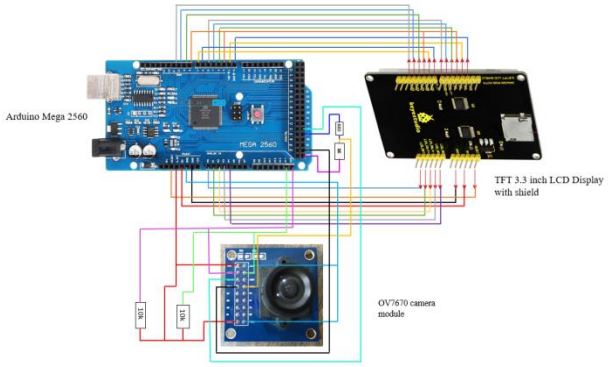
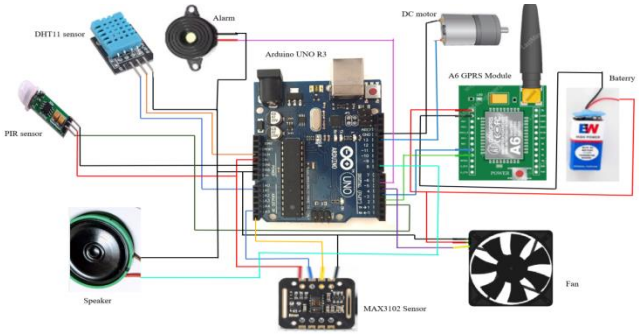


Figure 11: Circuit diagram of camera and LCD display used in smart Bassinet



4. Results & Discussion

WORKING PRINCIPLE

The whole operation of the smart cradle system is shown in the diagram in Figure 13 below. Several sensors, including a sound detector, a temperature sensor, a humidity sensor, a wetness detector are embedded in the entire system., It uses a PIR sensor, an OV7670 camera module, a heart rate monitor, an oximeter, and a piezoelectric sensor to track the movements of the child placed in the cradle.

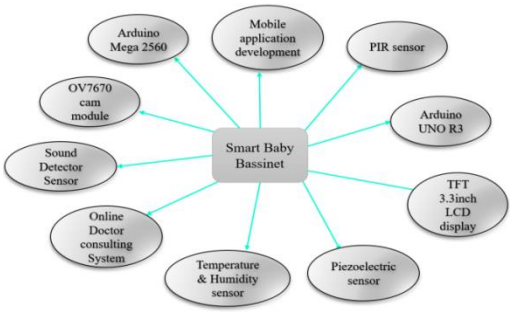


Figure 13. Proposed diagram of smart cradle system

The cradle is equipped with an alarm system that sounds in two different circumstances: first, when the pad is wet, which is essential for the baby's health; and second, when the infant continues to cry for a prolonged period of time, which may indicate that the baby wants attention.

The bassinet also has the ability to measure the temperature and amount of moisture around the baby, alerting the owner to the value via SMS or phone calls. The bassinet is fitted with a speaker so that rural areas people can easily understood what the bassinet is alerting to them. The speaker system is having different language option so that people from differ part of the world can easily understand in their native language.[12]

In addition, we've provided video enchantment choices so that parents can watch what their children are doing. While parents are gone from their babies, they can use mobile applications to monitor and operate the bassinet.

For health check-up system, the cabinet is having pulse rate measuring system, Bio2 measuring system. This measurement can directly send to doctor whenever needed. [20-22]

If the baby becomes ill, parents can use the video conference system's online doctor consulting system. At that time, the doctor can able to use the OV7670 cam module to see the patient which allows the doctor to see the infant as well as obtain heart rate and oximeter level data, as shown in Figure 14 below.

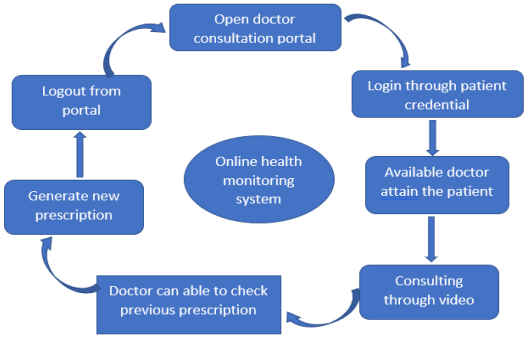


Figure 14. Workflow of online doctor consultation

FLOWCHART OF SOME SENSOR USED

In this section the flowchart of every sensors are depicted thoroughly.

Flowchart of Sound detector sensor:

LM393 Sound Detector Module is used for detecting the level of sound made by the baby while crying. It basically detect the crying intensity through the cradle will make alert notification and sound to parents and caretaker of the child. According to the flowchart first the sound detection module check is their any sound or not. Before that set the threshold sound level as of the detector will detect the other sound around the cradle. Now, if it detect sound and if it is above threshold value then it will again check whether the detect value equals to high frequency value or low frequency value. If it is high then the servo motor is set on to swing the cradle and cradle song will start playing. If sound level is low then it send sms to parent as baby is cryinh because of feeling hungry, along with cradle music will play. After that if again baby is crying then it will start playing animated videos and sent alert message to parents and nanny through GSM module.

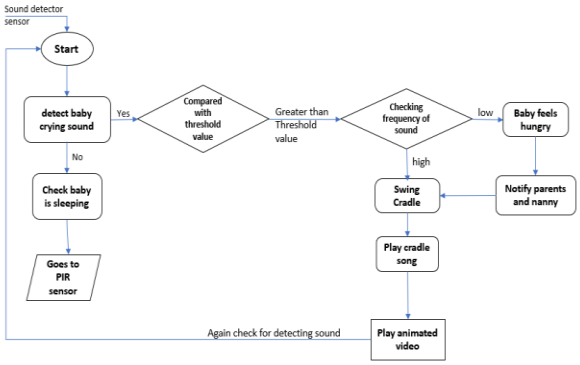


Figure 15: Flowchart of Sound detector sensor

Flowchart of Wetness detector:

Using YL-69 soil moisture sensor wetness around baby diaper is measured. Before starting the sensor, we have to declare the threshold value as moisture present in atmosphere which affect the sensor correct reading. After that the sensor check the moisture around the baby's diaper. If the sensed value greater than threshold value then it will immediately send SMS alert to parents and ring the alarm for informing the caretaker for an emergency.

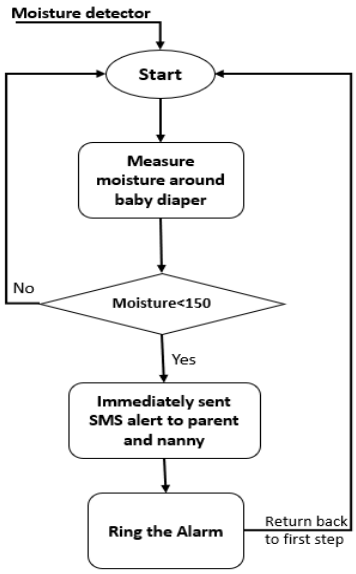


Figure 16: Flowchart of Wetness detector

Flowchart of PIR sensor:

To detect the presence of baby in the cradle in this paper PIR sensor is used. Firstly, PIR sensor is get initialized and collect the PIR reading. If the motion is detected then notify the parent that baby is present in the cradle, and if no motion is detected then also notify parent that baby is not present inside the cradle.

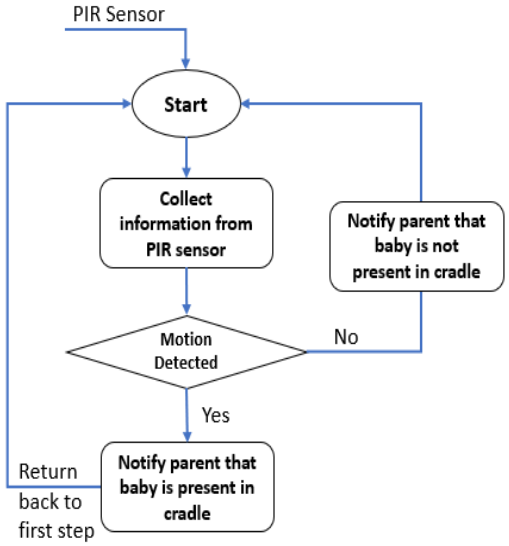


Figure 17: Flowchart of PIR Sensor

Flowchart of OV7670 cam module:

When the parent wants to see their infant what they are doing or wiling to talk with their infant then from mobile they need to click on video call and at infant end the camera will automatically start to operate. Then the recorded video transmits to parent phone if network is available otherwise it get stored in Buffer. Therefore, through camera the parent can able to see them can able to interact with them.

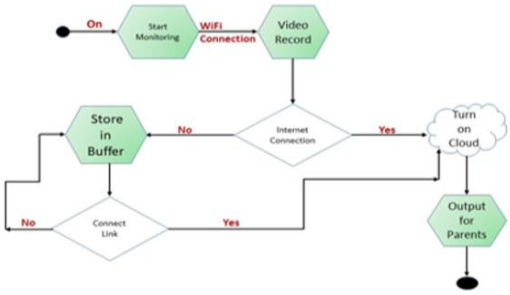


Figure 18: Flowchart of OV7670 cam module

Flowchart of Online Doctor Consulting System

For online doctor consulting system, the doctor and patient both need to register to the app. Now for patient point of view, the patient need to login/register. If the patient is already registered then they need to login to the app. Then check for nurse availability, if available then mentioned about the problem the patient is facing. If doctor is available then consult with the doctor and if not then wait until the doctor is available. After the patient get checked by the doctor if the need medicine then the prescription is generated automatically when the appointment get closed. After that the newly generated prescription get

stored in cloud for future use. And from doctor point of view they need to register themselves and make their profile so that patients can get doctor list to their specialist. After that the doctor must checked if they have any appointment or not. If they have appointment they need to attained that patient otherwise wait for the next appointment. In this way the online consulting system works.

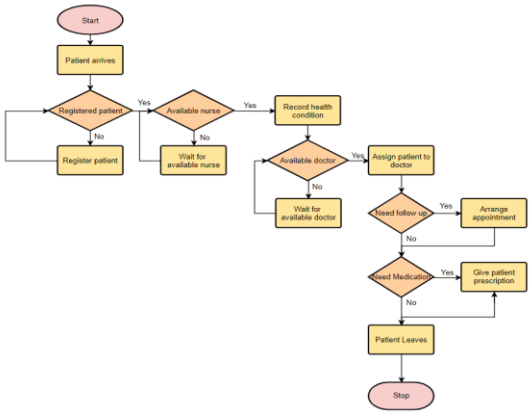


Figure 19: Flowchart of Online Doctor Consulting System

Working Project Images

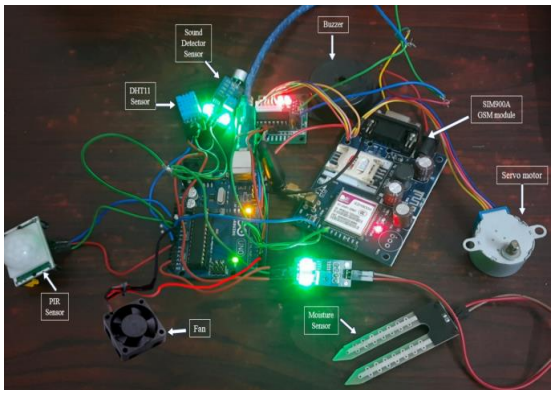


Figure 20: Top view of Circuit

The Smart Baby Cradle is an innovative approach towards smart baby care management. The system design combines cutting-edge technology with traditional baby care to create a safe and comfortable environment for infants. This intelligent cradle is designed to address the needs of modern parents, offering advanced features that ensure the well-being of babies while providing convenience and peace of mind to caregivers. The Smart Baby Cradle is equipped with a range of intelligent features. It incorporates an advanced monitoring system that tracks vital signs such as heart rate, breathing patterns, and body temperature along with humidity and surrounding temperature, wetness detector, crying detector and baby's presence detector. This real-time monitoring allows parents to stay informed about their baby's well-being.

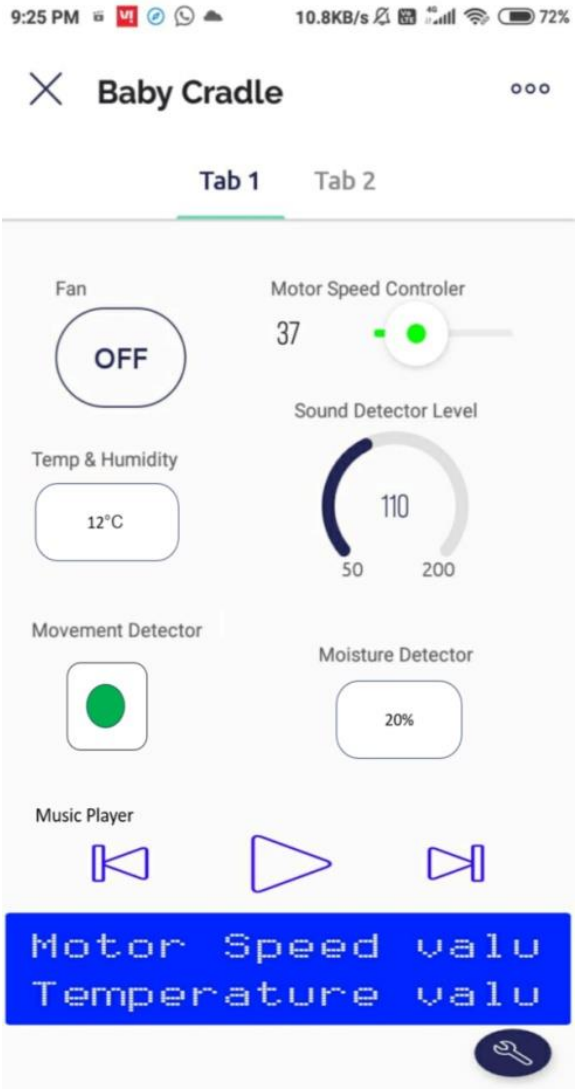


Figure 21: Mobile dashboard for Cradle

Furthermore, the cradle utilizes a built-in smart audio and video system, enabling parents to observe their child remotely. This feature provides a valuable sense of security, allowing parents to keep a close eye on their baby even from a different place like office. It also provides the two-way audio system allows for soothing communication between the parents and the baby. The Cradle is fitted with alarm or buzzer type to immediately notify anyone present near baby for immediate attention. The cradle employs an intelligent rocking mechanism that simulates the gentle motion of being cradled in a caregiver's arms. This rhythmic motion helps soothe and calm the baby, mimicking the familiar sensation of being rocked to sleep. The cradle's motion can be

customized through various settings, allowing parents to find the optimal rhythm that suits their baby's preferences. The Smart Baby Cradle is seamlessly integrated with mobile devices, enabling easy control and access to its features. Through a dedicated mobile application, parents can remotely monitor their baby, adjust the cradle's rocking speed and motion, and receive real-time notifications regarding the baby's status. This connectivity enhances convenience, allowing parents to manage the cradle's functions from anywhere within the house.

The Smart Baby Cradle project represents a remarkable fusion of technology and infant care, revolutionizing the way parents nurture their babies. With its advanced features, including real-time monitoring, remote observation, customizable rocking motions, and seamless mobile integration, this smart cradle offers unmatched safety, comfort, and convenience. By promoting healthy sleep patterns and providing caregivers with valuable insights into their baby's well-being, the Smart Baby Cradle sets a new standard in infant care, empowering parents with enhanced peace of mind and creating a nurturing environment for their little ones.

5. Conclusions

In order to emphasise the significance of Online health check-up Consultancy for all patients worldwide, a review of the literature was done. A smart bassinet with an IoT baby monitoring system is designed and manufactured to monitor critical parameters such as crying status, humidity, and ambient temperature. A smart baby crib has been designed and implemented based on several new technologies. The system helps parents during the day while they are busy and during the night while they are sleeping by swinging a cradle and playing cradle song.

In a word, the project's future scope is around the preservation of information pertaining to:

- We can provide more advanced software for Doctor Appointment System, as well as additional features.
- We can add the blood bank notification system in the mobile app.
- Integrate numerous load balancers to distribute the system’s load.
- Design the master and slave database structure to reduce database query overload

Integration of Ad Hoc Network with the baby Cradle

Baby Cradle uses a PIR sensor, an OV7670 camera module, a heart rate monitor, an oximeter, and a piezoelectric sensor, GSM module to track the movements of the Cradle. . Instead of these, we may use a wireless network adapter or chip which will be able to act as a wireless router when connected. Baby Cradle may be considered as an Ad Hoc Device to monitor the device by his/her parents/guardian. Ad Hoc network may be formed with the community peoples’ devices within the campus for any emergency requirements. In that case alarming system will not be required for monitoring the Baby Cradle. The GSM module of the Baby Cradle is used for voice messages so it can be utilised through a mobile network devices. Baby Cradle with its Ad Hoc peripheral devices forming the mobile Ad Hoc network will help for fast communication with the people. If the baby becomes ill online doctor consulting system will be easier. Online doctor consulting is possible if the doctor is with the campus and be included in the network system.

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