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# GSM Enabled Automatic Cradle with Music and Lighting System

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***Abstract:-*** The primary objective of this project is to address the critical need foradvanced infant care solutions with real-time communication. It aims to enhance the well-being of infants and provide peace of mind to parents and caregivers. It is developed to accurately interpret infant cries, enabling timely responses to the baby's needs by providing music and colorful lightings. Additionally, we aim to incorporate a GSM alert system to notify parents or caregivers of critical events and implement a cradle comfort control mechanismthat will wave the cradle whenever the baby cries. The GSM alert system ensuresthat caregivers receive instant notifications through calls regarding the baby's well-being and needs. It provides an innovative solution to enhance infant careand support parental responsiveness. The motivation behind our project is to address the challenges faced by caregivers in understanding and responding to infant needs, especially during the night or when separated from the baby. We achived that not only guarantees infants' comfort and safety but also provides parents and caregivers with a convenient and interactive childcare experience. We have also monitored outputs such as the baby's body temperature and moisture levels for comprehensive care and attention.
***Keywords:*** GSM, infants, caregivers, cradle comfort control.

**Introduction**

In the realm of infant care, marked by sleepless nights and the comforting of crying babies, a pioneering project arises, offering a revolutionary solution. Caregivers frequently confront the daunting task of promptly addressing their infant's cries, grappling with the challenge of applying effective soothing methods, and enduring the anxiety stemming from uncertainty about their baby's immediate requirements. Amidst these common struggles, a groundbreaking initiative emerges to alleviate these burdens. This project endeavors to redefine the landscape of infant care by introducing innovative solutions that cater to the intricate needs of both infants and their caregivers. By integrating cutting-edge technology and expert insights, it aims to provide caregivers with real-time data and actionable recommendations, empowering them to respond promptly and effectively to their infant's needs. Furthermore,this initiative seeks to enhance the overall caregiving experience by fostering a sense of confidence and assurance among caregivers, thereby fostering a more harmonious relationship between parent and child. In a world where the demands of infant care can be overwhelming, this project stands as a beacon of hope, offering a transformative approach that promises to revolutionize the way caregivers nurture and support their infants.The primary objective of this project is twofold: to enhance the well-being of infants and to provide peace of mind to parents and caregivers. In pursuit of thisgoal, this paper harnesses the capabilities of GSM (Global System for Mobile Communications) technology to innovate an automatic cradle. This cradle goesbeyond mere rocking; it incorporates an integrated music and lighting system, offering a comprehensive solution to the challenges faced in infant care. The ingenious combination of features in this automated cradle serves multiple purposes. Firstly, it ensures the safety and comfort of infants, addressing their physiological and sensory needs. The gentle rocking motion mimics the comforting sensation of being cradled in a caregiver's arms, promoting relaxation and facilitating sleep.

**Main text**

**Survey of literature**

NitaNimbarte, HuzaifKhan, Mangesh DilipSendre,Kiran Ramteke, proposed an New Born Baby Cry Analysis and Classification. The proposed method in this paper extracts MFCC (Mel Frequency Cepstral Coefficients) features from the audio signals of the baby cries and appliesKNN (K- Nearest Neighbor) to classify the cries based on their features. A baby's cry may be automatically detected in a few circumstances including different environmental noises. It is said that the suggested technique demonstrated high accuracy in identifying cry types when tested using a freely accessible data set.Thereview of a wide variety of literature focuses primarily on data gathering, processing of signals in cross domain, and classification using machine learning algorithms. When using various apps to monitor a baby's condition, automatic voice detection of a baby's cry is crucial. This hypothesized concept involves thedetection of a baby's scream. To distinguish infant sounds of crying in a range ofsettings which are residential under challenging circumstances, this system usesa machine learning technique.

Shivam Sharma, Vinay Kumar Mittal proposed an Infant Cry Analysis of Cry Signal Segments towards Identifying the Cry-cause factors.

This paper analyses different causes of infant crying that are characterized by examining the instantaneous fundamental frequency($F_0$) is extracted using auto- correlation of cry signal. Normalized standard deviation is highest for Pain, then for Environmental Change, then for Discomfort and lowestfor Stranger's Anxiety.A Infant Cry Signals Database (IIITS ICSD 2) is used, which was especially collected forth is study. Results are validated by observing changes in the F0 and its harmonics in spectrograms, derived using short-time Fourier transform. Few distinct patterns of changes in the F0 contours are observed for different cry causes. Pain cry is characterized by higher standard deviation in F0, than for Discomfort. The standard deviation in F0 for Environmental Change is more than for Stranger's Anxiety. Normalized standard deviation is highest for Pain, than for Environmental Change, than for Discomfort and lowest for Stranger's Anxiety. These insights should be helpful towards automated identification of infant cry-causes. LichuanLiu, WeiLiXianwenWu, Benjamin X.Zhou proposed an Infant Cry Language Analysis and Recognition: An Experimental Approach

In this paper, it is proposed that the audio features of infant cry signals are analyzed in time and frequency domains. Based on the related features, cry signals are classified to specific cry meanings for cry language recognition. Features extracted from audio feature space include linear predictive coding (LPC), linear predictive cepstral coefficients (LPCC), Bark frequency cepstral coefficients (BFCC), and Mel frequency cepstral coefficients (MFCC). In this paper, we obtain and analyze audio features of infant cry signals in time and frequency domains. lots of research has been directed towards natural language processing. AnjuKrishna, HarshaPonnamaDev,Lekshmi, Sneha Suresh, Rejani proposed an Smart Cradle by Using Messaging And Sensing Technology. This paper describes that this product can be used from birth to twelve months of babies to detect the infant's cry immediately and e-baby cradle that swings automatically with soft music. The speed of the cradle can becontrolled as per the user's need. The system has an alarm and GSM module andindicates two conditions, first when the mattress is wet, second when baby doesnot stop crying within a stipulated time which intimated the baby needs attention. This product is useful for working parents and hearing-impaired parents. 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. Claudia Manfredi, ValentinaTocchioni and Leonardo proposed an A Robust Tool For New Born Infant Cry Analysis. This paper describes the performance of F noise and resonance frequencies tracking, on signal frames of varying length. Voiced/unvoiced separation is implemented. Plots of F and its harmonics, noisetracking, spectrogram with resonance frequencies super imposed, are presentedin a coloured-scale. It does not need any manual setting to be made by the user,thus being easily usable also by non-experts. The new software tool is completelyautomatic, working with any sampling frequency and F0 and also with strongly corrupted signals, and does not need any manual setting of whatever option to be made by the user, thus being easily usable also by non-experts. Some examplesare reported, concerning both healthy and pathological new-born infant cries.

**3. Experimental Details**

**Cry Detection Technology**: The system starts with a sound sensor or microphone placed in the baby's room. This sensor continuously monitors theambient noise level, specifically focusing on the baby's cries.

**Real-Time Communication**: Simultaneously, the system utilizes real-timecommunication technology, such as

a GSM [cellular] network. It sends an alert call or send a notification to the smart phones of parents or caregivers, alertingthem that the baby is crying and that the soothing process has begun.

**Soothing Responses**: Upon detecting the cry and identifying its cause, the system triggers several soothing responses simultaneously.

**Music**: The system can play soothing music through a built- in speaker or a connected audio system to calm the baby.

**Colorful LED Lights**: Colorful LED lights in the baby's room can softly glow to create a calming environment.

**Cradle Movement**: In some advanced systems, a motorized cradle starts gently swinging when the baby cries. This motion can help comfort and lull thebaby back to sleep.

**Parental Monitoring**: The system might additionally provide a real-time audiofeed from the infant's room to the smart phones of parents or caregivers. This enables them to listen and evaluate the baby's state, aiding in their decision- making regarding whether intervention is necessary or if the baby is graduallysoothing down.

**The GSM Module (SIM 900)**: It is an extremely compact and dependable wireless module. The SIM900A offers a comprehensive dual-band GSM/GPRS solution in an SMT module format, enabling its integration into customer applications. This integration allows for the advantages of its small size and cost-effectiveness.

**Servo Motor (SG90)**: The SG90 Servo Motor is a small, lightweight motor withsubstantial output power. It has a rotational capability of around 180 degrees (90 in either direction), functioning similarly to standard servo motors but in amore compact size. Any servo code, hardware, or library can be employed to control these servos.

## 4. Working.

### A. Interfacing of Sound Sensor with Arduino

The sound sensor module generally includes a microphone designed to detect sound waves within its environment. Upon detecting sound, the sensor produces an electrical signal proportionate to the sound's intensity, transmitting it to the Arduino via the OUT pin. The Arduino consistently monitors the signal from the sound sensor by observingthe digital pin connected to the sensor's OUT pin. You can optionally set a threshold value in your Arduino code to determine when the sound level is considered significant enough to trigger an action. If the sound level exceeds this threshold, the Arduino can initiate specific actions, like sending data to other devices.


**Fig 4.1 Interfacing of Sound Sensor with Arduino**

### B. Interfacing of GSM Module with Arduino

The GSM modules establish communication with the Arduino through UART (serial communication). Link the TX (Transmit) pin of the GSM module to the RX (Receive) pin of the Arduino. Connect the RX (Receive) pin of the GSM module to the TX (Transmit) pin of the Arduino. Ensure that the grounds (GND) of both the Arduino and the GSM module are interconnected. Utilize suitable pins on the Arduino board to initiate serial communication with the GSM module. Depending on your Arduino model andcommunication requirements, you can employ software serial (such as the Software Serial library) or the hardware serial ports (Serial and Serial1).Experiment with diverse functionalities like sending SMS messages, making phone calls, or establishing internet connections, aligning with the objectives of your project.

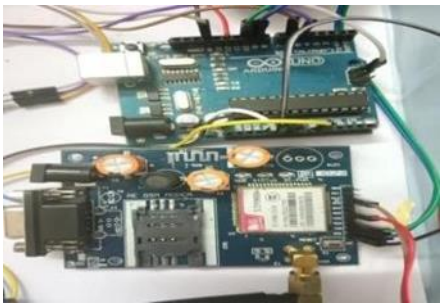


**Fig 4.2 interfacing of GSM Module with Arduino**

### C. Interfacing of Speaker,Df-Player Mini With Arduino

Initiate serial communication between the Arduino and the Dfmini player by connecting their TX and RX pins. Link the positive and negative terminals of the speaker to the corresponding pins on the DF-Player Minimodule. Establish a connection between the Df-Player Mini and the Arduino using digital pins dedicated to serial communication. Optionally, supply external power to the speaker if it demands more power than what the Arduino can provide. Subsequently, instruct the DF-Player Mini to initialize, adjust volume settings, and play designated audio tracks stored on the SD card.

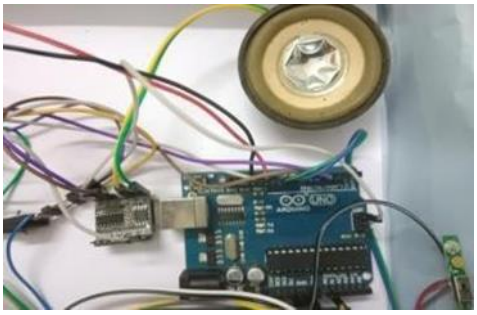


**Fig 4.3 Interfacing of Speaker, Df-Mini Player with Arduino**

### D. Interfacing of Led Strip

In the Arduino code, you set up three digital output pins (e.g., Pins 9, 10, and 11) configured for PWM (Pulse Width Modulation) to control the intensity of each color in the RGB LED. These pins will control the red, green, and blue components of the LED, respectively. Within the loop function, the Arduino continuously adjusts the PWM values on Pins 9, 10, and 11 to create specific colors on the RGB LED. By changing the PWM values on these pins, you can independently control the intensity of red, green, and blue light, allowing you to produce a wide range ofcolors.

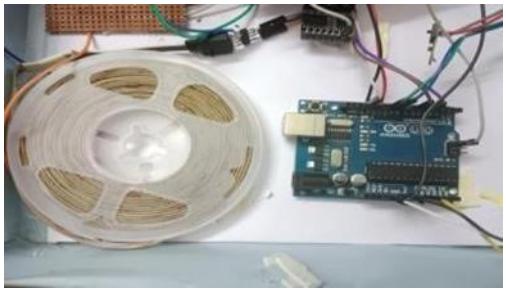


**Fig 4.4 Interfacing of Led Strip**

### E. Interfacing of Servo Motor.

When the Arduino transmits a signal while the servo motor is linked to the cradle, it triggers the servo motor, commencing agentle swinging action of the cradle. This calming motion aims to offer comfort to the baby and presents a pragmatic approach to infant care, thereby improving the overall care giving experience.

**Fig 4.5 Interfacing of Servo Motor**

**F. Interfacing of Wet Sensor.**

Connecting a moisture sensor, also known as a soil moisture or wetsensor, to an Arduino enables you to measure moisture levels in soil or other materials. This can be beneficial for applications like automated watering systems, plant care, and monitoring environmental conditions.

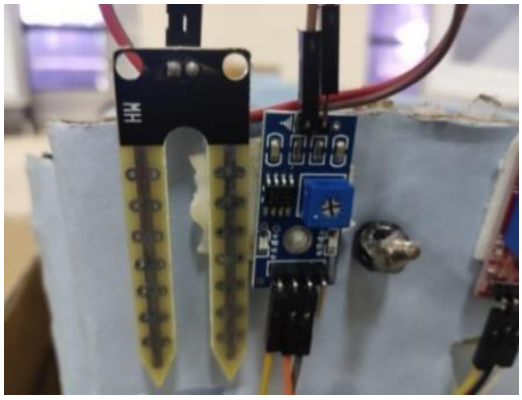


**Fig 4.6 Interfacing of Wet Sensor**

**G. Interfacing of Temperaturesensor**

Interfacing a temperature sensor with an Arduino allows you to measure temperature in your projects, enabling applications such as environmental monitoring, temperature control systems, and data logging.**FIG**

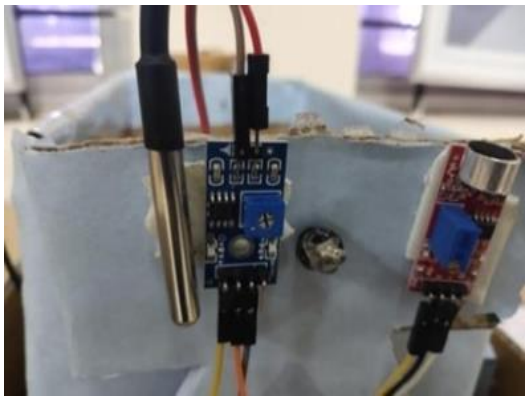


**Fig 4.7 Interfacing of Temperature Sensor**

**H. Interfacing of Centrifugal Fan.**

Interfacing a centrifugal fan with an Arduino allows you to controlthe speed and possibly the direction of the fan. This can be useful for various applications such as ventilation, cooling, and air circulation.

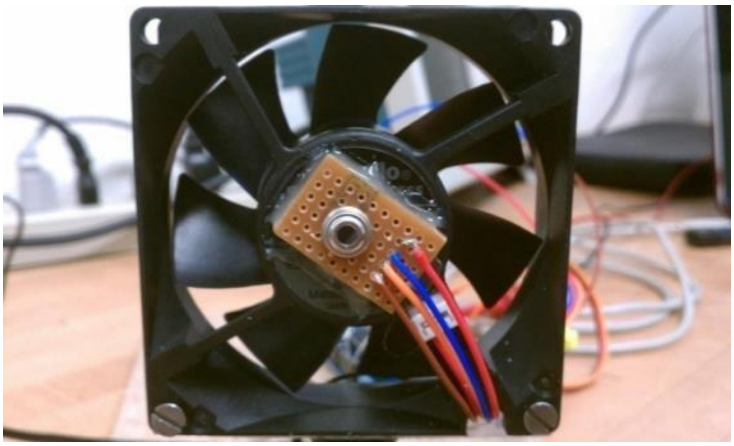
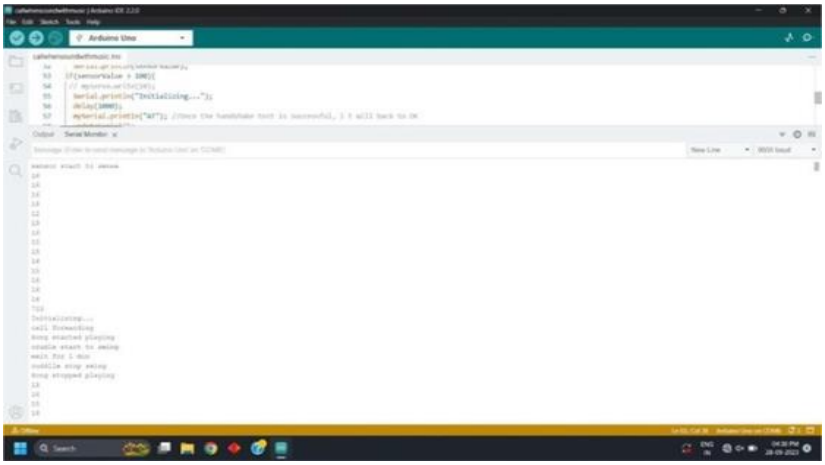


**Fig 4.8 Interfacing of Centrifugal Fan**

## 5. Results

### A. Serial Monitor Output

This figure 5.1 illustrates the voltage levels obtained from the soundsensor's output.



**Serial Monitor Output**

### A. Temperaturesensor Output

This figure 5.2 constantly tracks the infant's body temperature andpresents the corresponding readings.


**5.1 Temperature Sensor Output**

### B. Wetsensor Output

This figure 5.3 monitors the baby's moisture level continuously anddisplays the relevant information as the

output.


**5.2 Wet Sensor Output**

## 6. Conclusions

In conclusion, the project aims to address a range of challenges faced by both infants and caregivers. These challenges include difficulties in responding to infant needs, disrupted sleep patterns, limited tools for soothing, and a lack of real-time communication. By combining cry sound detection technology with responsive systems like music, lights, cradle movement, and GSM alerts, the project strives to enhance infant well-being, improve caregiver confidence, and provide a more secure and peaceful environment for both infants and caregivers. Inaddition to the challenges outlined above, the project also focuses on promoting effective communication between infants and caregivers, ensuring the emotional well-being and security of infants, and addressing safety concerns during sleep. By tackling these multifaceted issues, the project seeks to offer a comprehensive solution that not only alleviates immediate problems but also contributes to the overall development and happiness of infants and the peace of mind of their caregiver.

## 7. Declaration

Availability of data and materials:

All data generated or analysed during this study are included in this published article [and its supplementary information files].

COMPETING INTERESTS:

The authors declare that they have no competing interests.

FUNDING:

The authors did not receive support from any organization for the submittedwork. No funding was received to assist with the preparation of this manuscript.No funding was received for conducting this study.

AUTHORS' CONTRIBUTIONS:

MV contributed to the fabrication of the product, while VK and YP wereinvolved in hardware tasks and code verification. KM provided support to othersand interfaced Arduino with other components. All authors reviewed and approved the final manuscript.

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Not applicable

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