5th International Conference on Smart Electronics and Communication (ICOSEC 2024)
IEEE Xplore Part Number: CFP24V90-ART; ISBN: 979-8-3315-0440-3

2024 5th International Conference on Smart Electronics and Communication (ICOSEC) | 979-8-3315-0440-3/24/$31.00 ©2024 IEEE | DOI: 10.1109/ICOSEC61587.2024.10722336

Technology Enhanced Cradle by using Sensors and Internet of Things

Thangam S, Mogili Greeshma, Mekala Varun, NVS Sanjana, J Jesy Janet Kumari
Department of Computer Science & Engineering
Amrita School of Computing, Bengaluru
Amrita Vishwa Vidyapeetham, India
s_thangam@blr.amrita.edu, bl.en.u4aie22031@bl.students.amrita.edu,
bl.en.u4aie22037@bl.students.amrita.edu, bl.en.u4aie22041@bl.students.amrita.edu,
bl.en.r4cse21008@bl.students.amrita.edu

***Abstract*—Conventional cradles lack the ability to monitor and support infants continuously or adapt to varying needs. This study proposes a novel smart cradle equipped with advanced sensors and actuators, enabling parents to control environmental factors in real time, thereby ensuring the highest levels of safety and comfort for infants. Unlike previous models, the smart cradle automatically responds to stimuli, such as an infant's cry, and allows for remote monitoring via the Blynk app. Comparative analysis demonstrates that the proposed smart cradle offers faster response times and greater accuracy in environmental control compared to recent models, establishing it as a new benchmark in infant care products. This innovation addresses the deficiencies of current cradle designs and represents a significant advancement in automated infant care systems, ultimately conserving caregivers' resources and improving overall infant care.**

***Index Terms*—IoT, Sensors, Blynk App, Technology-Enhanced Cradle, Infant Care, Real-Time Monitoring, Safety and Comfort, Cry and Wetness Detection, Voice Recorder**

I. Introduction

In today's fast-paced world, where the demands of parenting can sometimes feel overwhelming, there is a growing need for innovative infant care solutions. Enter the Science-Enhanced Cradle, a revolutionary blend of the latest technology and traditional safety measures. This Technology-Enabled Cradle stands out because it integrates cutting-edge sensor technologies and advanced automation, designed specifically for modern families. Unlike conventional cradles, which offer limited features, this new cradle connects to real-world monitoring systems to track the baby's vital signs, ensuring their health and safety. The Science-Enhanced Cradle provides parents with 24/7 notifications about their baby's health status, including crucial metrics like heart rate. This continuous stream of information enables parents to address any issues promptly, enhancing their baby's well-being and safety. The innovation doesn't stop there. The Tech-Equipped Cradle includes features that enhance both the baby's and parents' comfort and convenience. For instance, the peaceful crying system automatically rocks the crib in response to the baby's cries, allowing the baby to sleep peacefully while minimizing disturbances for the parents during late-night hours.

Additionally, the integrated fan maintains the nursery's temperature effectively, ensuring the baby's comfort and reducing the risk of skin irritations. The Science-Enhanced Cradle prioritizes safety with robust security measures, protecting confidential information and ensuring the integrity of the monitoring system. With encryption and multi-factor authentication, parents can trust that their baby's data is secure, even amidst rising cybersecurity concerns. Beyond benefiting parents and babies, the Tech-Enhanced Cradle also has the potential to advance paediatric healthcare research and innovation. By collecting data from numerous cradles worldwide, researchers can gain insights into infant health trends, identify areas for improvement in care protocols, and develop more personalized and effective treatments.

The Science-Enhanced Cradle represents a breakthrough in infant care. By combining advanced technology with practical features and integrating seamlessly into daily life, this innovation not only supports the well-being of both parents and babies but also contributes to the advancement of paediatric healthcare and research globally. However, data security and privacy remain significant challenges due to the sensitive nature of the transmitted health information. Power management is also crucial for the cradle's functionality; monitoring may be difficult in remote areas far from main centres. Additionally, network issues and the high cost of training to use the technology effectively can impact cost-effectiveness.

II. Literature Survey

Kulkarni et al. [1] showed that smart cradles were electronic devices equipped with sensors and artificial intelligence, providing information about the environment and vital signs. Cameras and facial recognition software stopped unwanted access, and the lack of entertainment and gadgets. This system lacks in sleep pattern analysis. Susarla et al. Savithri et al. [2] combined Arduino to integrate sensors for room temperature, moisture, and cry detection, thus guaranteeing comfort and continuous real-time data monitoring, developing better safety systems, and enabling remote control through a smartphone app. This system can include health monitoring and analysis for a more efficient

Authorized licensed use limited to: Amrita School of Engineering. Downloaded on December 19,2024 at 08:06:17 UTC from IEEE Xplore. Restrictions apply.

system. Nazee et al. [3] explained the creation of a smart crib that had an up-to-date newborn care monitoring system using cloud computing, Raspberry Pi, and Arduino IoT technologies. The system monitored vital signs in real-time, ensuring a secure environment for the baby. This system has issues in adaptability and scalability. Joshi et al. [4] explored IoT-enabled childcare products, focusing on wetness detection, infant monitoring systems, and smart cradles. It lacks in environmental sensing, cry detection accuracy, remote control capabilities, safety concerns, and long-term monitoring.

Susarla et al. [5] combined hardware parts such as Arduino Uno, servo motor, moisture sensor, and buzzer for wetness detection. The system perceived the baby's cries and wetness, thereby operating the servo motor and buzzer, while the gap exixts in utilizing machine learning to recognize the baby's emotions through facial expressions, thus allowing parents to receive warnings to take immediate action. Kaita et al.[6] believed that biometric sensors could be used for health monitoring and early diagnosis of infant problems, and cry detection algorithms could be enhanced for better accuracy. With a small fan, buzzer, and servomotor as outputs and a wetness module sensor, ESP32 camera, and DHT11 sensor as inputs, an Arduino Nano and a Node MCU were used to communicate with the Blynk program to control the system. When the system was turned on, it alerted the parents and monitored the baby's surroundings for simultaneous interruptions. In addition to triggering the swinging motion of the cradle and warning parents when moisture on the mattress suggested a diaper leak, the DHT11 sensor-controlled temperature by turning on the fan when it sensed a temperature higher than 28 degrees Celsius. There is no health monitoring of the baby in this sytem which is actually a required feature in smart cradles.

Kumar et al. [7] proposed an IoT gadget that monitored an infant's vital signs and surroundings using a lightweight RNN architecture, providing remote access to their health. This system can be enhanced by adding features like recording voice and playing them, automatic swing for the cradle and also connecting the data recorded to one's phone. Thangam et al. [8] reviewed prediction studies that had used machine learning algorithms including AdaBoost, XGBoost, Decision Trees, Random Forests, and SVC, focusing mainly on patients' characteristics such as age, sex, hereditary factors, and serum markers. The accuracy of the SVC model in forecasting relapse in patients on day one and day three after admission was better, while XGBoost performed exceptionally well on day two. Technical issues lies in the need for larger data sets, potential biases in data collection, interpretation problems with complex algorithms, and the challenge of adapting models to the dynamics of patient structure and treatment posed significant barriers to deeper integration of AI into medicine.Prathap et al. [9] suggested that AI-driven tailored alarms and integration with health monitors were potential future improvements that could enhance the standard of baby care. Working with specialists and pursuing sustainability initiatives could improve the system even more. With the use of sensors for temperature, moisture, pulse rate, and posture tracking, the smart baby monitoring system could provide caregivers with real-time alerts through the Blynk app. Wearable health monitoring for comprehensive newborn care and AI algorithms for predictive alarms were possible future advances. Voice commanding and automatic swing features can be added to this system.

Chauhan et al. [10] used a baby monitor with a camera, motors, and sensors to monitor and respond to a baby's needs, including weeping and moisture. Powered by an Arduino microcontroller, it was suitable for hospitals, daycare, and working parents. The gaps in the project lies in including servo motors for cradle rocking, a surveillance camera, and GSM modules for remote communication.Patil et al. [11] used a motor to swing the cradle and included sensors for temperature, humidity, and sound detection. Node MCU transmitted data via a WiFi connection, allowing real-time monitoring using a mobile app. Although the system depended on network connectivity, it was efficient but these upgrades addressed concerns related to network reliability. Kavitha et al. [12] examined contemporary baby monitoring devices, which combined several sensors to give newborns complete medical attention. These technologies ensured prompt assistance and comfort by detecting and reacting to a variety of signals. In-depth signal processing and alerting systems that enabled parents to receive alerts on their mobile devices were also explored in this study. The study highlighted the convenience for caregivers as well as the contribution to the safety and well-being of the infant. The addition of sleep monitoring features and cameras with night vision will make this sytem more efficient.

Sonia et al. [13] described that the Internet of Things (IoT) smart cradle employed sensors to monitor baby-related parameters like noise, humidity, and temperature. The cloud was then used to analyze this data. Music players and other gadgets reacted to these readings to keep babies comfortable.If circumstances required attention or exceeded safe bounds,parents were informed.This system can include health monitoring and analysis for a more efficient system. Durga et al. [14] incorporated sensors for room temperature, moisture, and cry detection with Arduino. When a child screamed, a sound sensor would gently rock the baby, and moisture sensors would notify parents when the child was wet. Comfort was ensured by monitoring the room temperature. A camera and microphone integrated into a 3D-designed cradle enabled continuous monitoring and notifications. It included functions like real-time data monitoring for ongoing development, improved safety measures, and remote control via a smartphone app.This system can include health monitoring and analysis for a more efficient system.

Authorized licensed use limited to: Amrita School of Engineering. Downloaded on December 19,2024 at 08:06:17 UTC from IEEE Xplore. Restrictions apply.

Thangam et al. [15] indicated that a driver getaway considerably impacted safety and was crucial for applications like autonomous driving as well as insurance assessments. In their study, deep learning and convolutional neural networks were used for detecting driver distractions independently by employing the State Farm dataset comprising 10 particular actions of 26 subjects. Challenges in intelligent transportation systems included understanding drivers' behavior, which was the main emphasis of this research, involving the improvement of detection of distracted driving behaviours such as texting, phone usage, and reaching behind. The endeavour sought to improve the detection of this behaviour to decrease the traffic accidents attributed to distracted driving.

Joseph et al. [16] created a reliable infant monitoring system that tracked vital signs using remote technologies and monitored screams using sound sensors. This technology provided improved cost-effectiveness and user-friendliness while overcoming current constraints. Potential gaps could involve the incorporation of wearable technology and improved remote access functionalities, offering caregivers a wider range of instruments to oversee their newborns' welfare. Joshi et al. [17] explored IoT-enabled childcare products, focusing on wetness detection, infant monitoring systems, and smart cradles. It highlighted gaps in environmental sensing, cry detection accuracy, remote control capabilities, safety concerns, and long-term monitoring. Rajesh et al. [18] proposed a wearable safety system for women, activated by a button or sensor changes, utilizing GPS tracking and email alerts for emergency assistance. Future enhancements involved integrating additional communication channels such as SMS or app notifications and implementing AI algorithms for more advanced threat detection and response.

III. Methodology

The smart cradle system is a unified system of sensors and modules that work together to provide the care of the infants that they need. Usually, the structure has a lot of sensor modules such as rain detection, sound detection, temperature sensing, and heart rate monitoring, each of which is connected to a microcontroller unit. The microcontroller unit is the heart of the system, it gets the sensor data and executes the control commands. It is linked to a Wi-Fi module, hence, remote monitoring and the remote control via the Blynk app is possible. Besides, the system has a voice recording module that produces calming sounds and songs that are played back. The architecture will facilitate the components to be connected seamlessly, hence the data will be transferred instantly and the baby's needs will be met right away. The primary objective of this architecture is to build a reliable and solid system that will guarantee the safety and health of the baby in any situation.

A. Algorithm

Algorithm 1 Smart Cradle System

Result: Automated soothing and monitoring of a baby.
Input : Noise level, wetness, heart rate, surrounding temperature, water moisture level
Output: Cradle status, fan status, noise level, heart rate, temperature, moisture data

Start while *True* **do**
  if *the baby is crying* **then**
    i) Swing the Cradle ii) Continuous Noise Level Monitoring through the Blynk app
  end
  if *the baby is still crying* **then**
    i) Play recorded parents voices or lullabies
  end
  if *wetness is detected* **then**
    i) Turn on the relay module (Fan)
  end
  if *the baby stops crying* **then**
    Stop swinging the cradle
  end
  Simultaneously record heart rate, surrounding temperature, noise level, and water moisture level using the Blynk app Parents can view the data
end
Stop

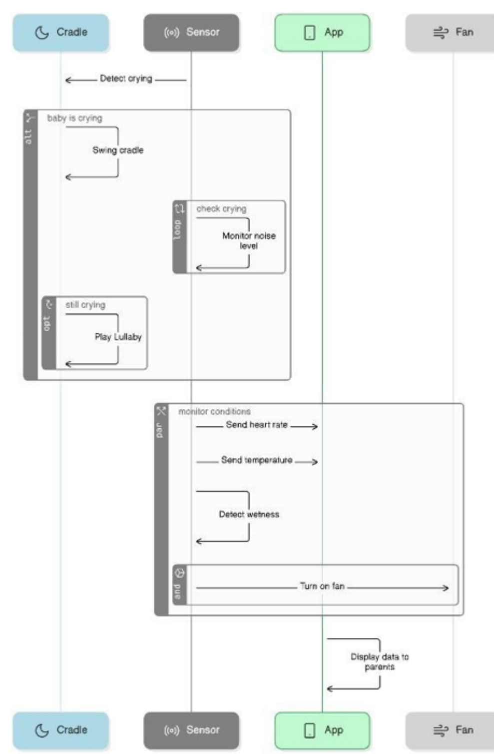

Fig. 1. *Sequence Diagram*

Authorized licensed use limited to: Amrita School of Engineering. Downloaded on December 19,2024 at 08:06:17 UTC from IEEE Xplore. Restrictions apply.

The algorithm that directs the smart cradle system is the one that controls the activities of the sensors, actuators, and microcontroller unit. Consider Fig 1, After the start of the system, the system enters a monitoring loop, which in turn collects the data from the sensors. The trigger event, e.g. the detection of rain droplets or the sound of the baby's cry, activates the algorithm that is responsible for responding to the situation. This is one of the instances where the rain droplets are detected and the algorithm tells the servo motor to start swinging the cradle motion. The algorithm will also do the same thing when the baby's cry is detected, it will begin to play the calming sounds by the voice recording module. On the other hand, the system is continuously monitoring the baby's temperature and heart rate which in this way, the environment is modified for the baby's comfort and safety.

The Blynk app is an IoT platform that enables users to control and monitor devices through customizable dashboards remotely. It supports various hardware platforms, making it versatile for IoT projects. Using the Blynk app, you can simultaneously record heart rate, surrounding temperature, noise level, and water moisture level by integrating the respective sensors with a compatible microcontroller. The app allows parents to view real-time data through customizable widgets on their smartphones. Each sensor's data is transmitted to the Blynk cloud, ensuring continuous monitoring and immediate access. Parents can receive alerts if any readings deviate from set thresholds, enhancing proactive care. This setup simplifies tracking multiple environmental factors and health metrics in one convenient interface.

The methodology includes several crucial strategies to ensure the proposed IoT-based tech-enhanced cradle system achieves high accuracy and reliability. The system uses carefully selected, high-quality sensors, such as the DHT11 for temperature monitoring, and ensures these sensors are regularly calibrated for precise data collection. Continuous monitoring is supported by the Blynk app and reliable Wi-Fi communication, which facilitates prompt alerts to caregivers. Additionally, the system prioritizes efficient power management and a robust architecture to prevent interruptions in operation, with rigorous testing conducted under varied conditions to confirm system performance. This methodical approach is designed to deliver an accurate and dependable monitoring solution.

B. Architecture Diagram

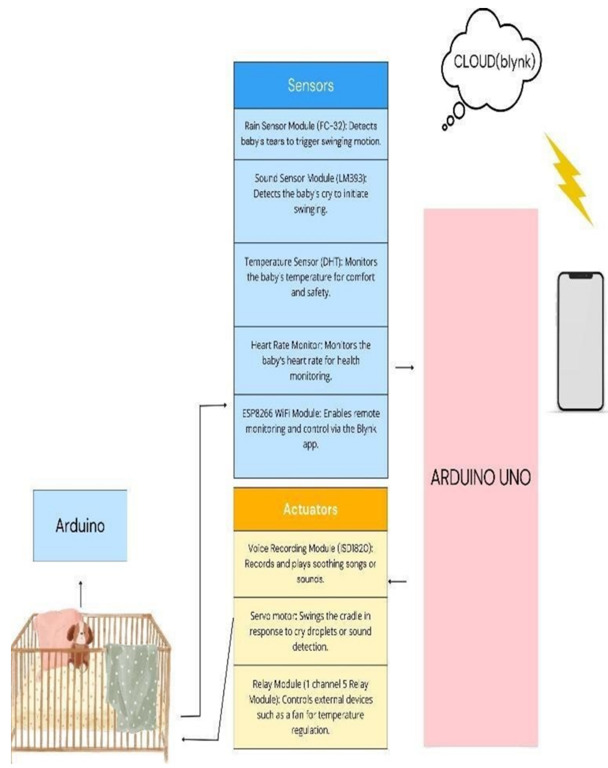

Fig. 2. *Architecture Diagram of Smart Cradle*

IV. Implementation

A. Hardware Implementation

The smart cradle system is realized through the integration of diverse hardware components to form a unit that is both responsive and capable of taking care of the baby.

The required Hardware components for the project were stated in Table 1.

1) Arduino UNO: LM393 chip in the sound sensor module serves the function of detecting sound by comparing the incoming signals with a reference level, which is then converted into digital signals, making it possible to process the sound easily by the microcontrollers or other devices. par *2) Relay Module*: Relay Module which controls the operation of the DC Fan and Speaker based on sensor readings or commands .

3) Temperature DTH11 Sensor: tThe DHT sensor which not only measures humidity but also temperature and thus, it gives the digital output that can be interfaced with microcontrollers for the microcontroller to monitor the environmental conditions.

4) Heart Rate Sensor: Heart rate sensor which measures the baby's heart rate, thus giving important information on the baby's health status .

5) Rain Droplets Detection Sensor: Rain detection sensor module which is essentially built to sense the existence of rain or moisture. It usually uses the conductivity-based or

Authorized licensed use limited to: Amrita School of Engineering. Downloaded on December 19,2024 at 08:06:17 UTC from IEEE Xplore. Restrictions apply.

TABLE I
HARDWARE COMPONENTS

Hardware Components			
S.No	Hardware Components	Specifications	Quantity
1	Aurdino Uno	Single-board microcontroller Availability Uno R3 webpage	1
2	ESP8266 Wi-Fi Module	ESP8266 12E, IEEE 802.11 b/g/n Wi-Fi Network	1
3	DHT11 sensor	DHT11, 3.5-5.5V power	1
4	Relay Module	Current is 10A & the max contact voltage is 250V AC & 30V DC	1
5	Servo motor	Rated Power W 2.2KW	1
6	LM393 chip	Supply Range: 2.0 Vdc to 36 Vdc. Split–Supply Range: ±1.0 Vdc to±18 Vdc	1
7	Rain detection	3.3 5 Voltage	1
8	Heart Rate Sensor	3.3V power, Analog output	1
9	ISD1820 Voice	Single-chip voice recording, no-volatile storage, and playback capability for 8 to 20 seconds.	1
10	Bread Board	Connection platform, 0.1” spacing, 1A current	1

capacitive sensing method to measure the water droplets on its surface. It is thus when the rain is detected, an output signal is generated that can be used to alarm, close windows, or control irrigation systems, hence giving various applications the desired environmental data.

6) Arduino UNO: Arduino which acts as the main controller, managing all connected sensors and actuators within the cradle.

7) Voice Recorder: The ISD1820 Voice Recording Module which is a compact board that enables easy recording and playback of audio messages with onboard storage and playback capabilities, ideal for various applications requiring simple voice recording and playback functionality.

8) ESP8266 Wifi Module:Fig 10 represents Wi-Fi module which enables Wi-Fi connectivity for communication with other devices or the internet.

9) Servo Motor: Servo motor which is a kind of motor that uses feedback control to exactly put its output shaft in a desired position. It is mostly employed in robotics and automation to get precise angular control, with the uses ranging from the control of steering mechanisms in RC vehicles to the position of the arms in industrial robots.

10) BreadBoard: Breadboard which is a reusable tool for prototyping electronic circuits without soldering. Its grid layout of holes and connection strips allows temporary connections between components, enabling easy assembly, modification, and testing of circuits. Assembling circuits, making them invaluable for beginners, hobbyists, students, and professionals in electronics

Fundamental elements include the Rain Sensor Module (FC-32), which detects falls and triggers the swinging of the cradle. Similarly, the Sound Sensor Module (LM393) recognizes the baby’s cry, initiating the swinging motion to calm the baby. The ISD1820 Voice Recording Module stores soothing songs or sounds and plays them back when needed.

Temperature tracking is facilitated by the Temperature Sensor (DHT), ensuring the baby’s comfort and safety. The Heart Rate Monitor provides vital health information that is highly useful for caregivers. The ESP8266 WiFi Module enables remote control and monitoring via the Blynk app, allowing caregivers to check temperature, sound levels, and heart rate, as well as control additional devices such as fans through the relay module.

This method is the most secure and efficient way to conduct testing and calibration. The system validation involves combining all sensors and modules to verify their functionality and calibrating the instruments to set the sensitivity for sound, rain, and temperature detection. The safety measures are created to avoid possible dangers, for instance, they control the swinging by making sure it is not too rough and is moderate and they monitor the temperature accurately to prevent overheating or chilling. Thus, the carers will be assured that they will be able to have a feeling of security, comfort, and peace of mind for themselves and the baby because of the smart cradle system

Authorized licensed use limited to: Amrita School of Engineering. Downloaded on December 19,2024 at 08:06:17 UTC from IEEE Xplore. Restrictions apply.

V. State of the art Implementation

TABLE II
State of the Art Implementation

Previous work	Proposed Work
Joshi et al. focused on IoT-enabled childcare products, such as wetness detection, infant monitoring, and smart cradles. However, their system lacked environmental sensing, accurate cry detection, remote and automatic control capabilities, safety considerations, and long-term monitoring.[4]	In the present work, the system expands on IoT-enabled childcare products by integrating environmental sensing, improved cry detection accuracy, and remote control capabilities. The system also introduces safety features and long-term monitoring for monitoring the safety of the baby.
Chauhan et al. developed a baby monitor system with a camera, motors, and sensors to monitor and respond to a baby's needs, such as crying and moisture detection. However, their system lacked servo motors for automatic cradle rocking and health monitoring features like heart rate and temperature tracking.[10]	Our system enhances Chauhan et al.'s work by adding health monitoring, including heart rate and temperature sensors, as well as an automatic cradle swing feature. Unlike Chauhan et al., our system does not include cameras. These additions make our system more focused on infant well-being.

One important problem that was solved was that the monitoring data should be capable of covering the whole health condition of the user. However, compared to the previous types [4][10][14][15][6][2] of smart cradles that possessed only the ability of reacting automatically to immediate issues such as wets and crying's, our proposed design has advanced health monitoring competence. In addition to the sensors which are capable of capturing heart rate, temperature, and breathing rate leading to timely medical intervention, our system enables paediatricians to track the baby's health status in real time. These are the key bodily functions that will be continuously checked with the help of sophisticated systems, the irregularities in which are one of the symptoms that can point to a disease. In case of any suspicious changes system gestures warning parents in hopeful way so that parents do this only when it needed and seek medical attention. This comprehensive take on baby monitoring not only proved that the child was comfortable and in good health, but also already had relief for the parents for being constantly aware that their baby is being monitored all the time.

VI. Results and Discussion

The integration of advanced sensor technologies within the framework of the tech-enhanced smart cradle signifies a remarkable advancement in infant care, revolutionizing the way caregivers nurture and safeguard infants. This innovative approach transcends conventional cradle designs by leveraging a sophisticated amalgamation of sensors and actuators, each meticulously orchestrated to create an unparalleled caregiving experience. At the heart of this technological marvel lies a network of sensors meticulously calibrated to detect and interpret a myriad of environmental stimuli. Rain and sound sensors are like sentinels, standing alert for even the slightest change in the weather or the environment. These sensors, along with the temperature and heart rate monitors, make a complete system of monitoring the infant's health that never tires to do his job. The intelligence of the smart cradle is not only limited to passive observation; it can change according to the needs of the time.

The servo motors and relay modules that are controlled by complex algorithms make the cradle able to react in a realtime to the cries of the infants. The moment when the rain droplets pat against the windowpane, white, the beat starts and the cradle is ready to carry on its work. It modifies its features to make sure that the room is warm and comfortable. Moreover, the cry of a baby sets in motion a chorus of outcomes that to soothe, such as the gentle rocking and the playing of lullabies. Importantly, the advantages of this technological miracle are not limited to the nursery setting. By the phone application, Blynk, the caregivers are given new worldwide access to vital parameters and environmental data in real time, no matter where they are. Having this precious knowledge, the caregivers can make the right decisions and take action to improve the infant's welfare, even if they are not present physically.

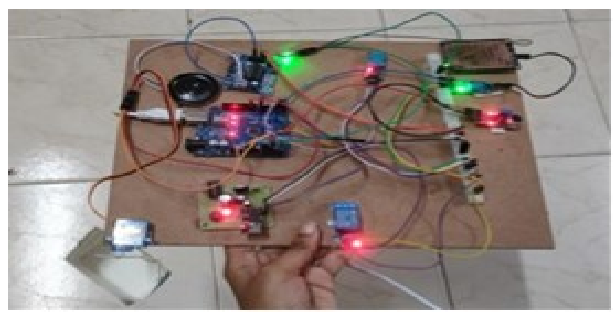

Fig. 3. *Hardware Implementation of Smart Cradle*

In short, the tech-based smart cradle is beyond its ordinary alternative, being a comprehensive solution for infant care. It is not only a source of comfort for caregivers but also the level of care will be raised to a new level. By the fusion of state oftheart sensors and responsive feedback mechanisms, it is the embodiment of innovation in infant care, and through its replacing the conventional methods of baby care, it is leading the way for the future of nurturing excellence.

When baby cry, the cry is recorded and if the cry exceeds 100db then the cradle will start automatically swinging. If the bed gets wets the relay module gets on turning on the fan and parallelly swings the cradle also. The temperature is continuously monitored through blink app. Baby's heart rate, cry, wetness of the bed is also continuously monitored in Blynk app. Notifications are sent to the phone if the bed gets wet indicating parents or the caretaker to change the diaper.

VII. Conclusion and Future Scopes

With remote monitoring and control via the Blynk app, caregivers can oversee and adjust the environment as needed, providing peace of mind. This proactive and adaptive

Authorized licensed use limited to: Amrita School of Engineering. Downloaded on December 19,2024 at 08:06:17 UTC from IEEE Xplore. Restrictions apply.

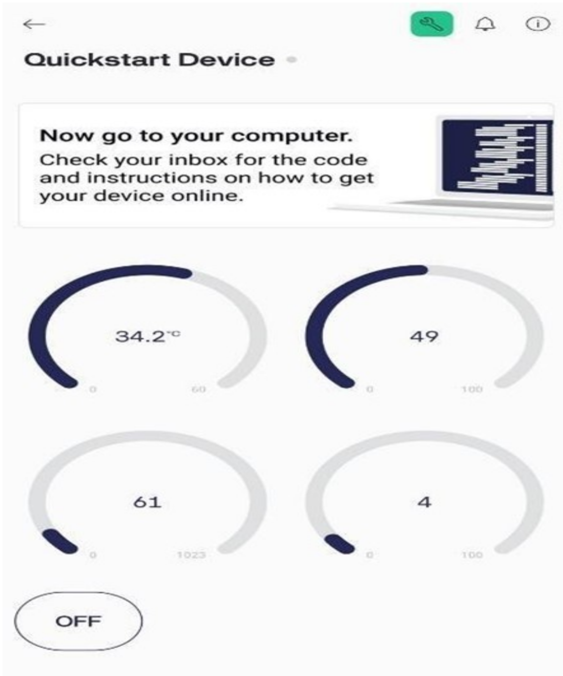

Fig. 4. *Continous monitoring in Blynk App*

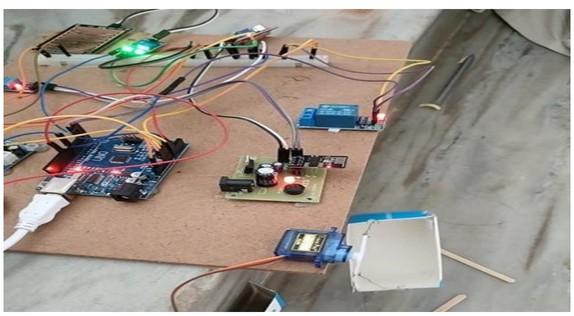

Fig. 5. *Cradle Movement*

system is designed to offer optimal care for infants while ensuring convenience and reassurance for caregivers. Looking towards the future, potential enhancements may include integrating voice command functionality, allowing caregivers to interact with the system seamlessly and further enhancing its convenience and accessibility. Future developments may also involve the application of advanced AI algorithms to evaluate the baby's behaviour patterns, enabling personalized responses such as modulating the swinging motion or playing soothing sounds based on individual preferences.

Additionally, machine learning technologies could enable the system to modify and learn from caregivers' feedback, facilitating continuous improvement. This would further optimize baby care and contribute to a more relaxed and informed parenting experience.

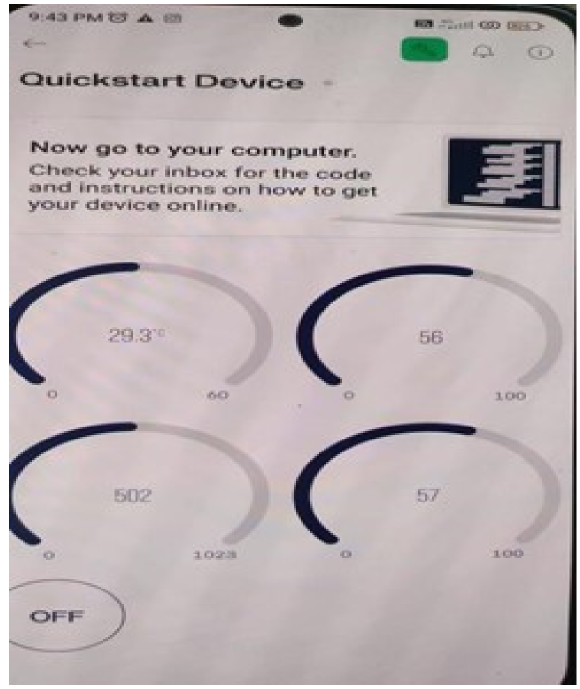

Fig. 6. *Heart Rate Monitoring*

REFERENCES

[1] P. V Kulkarni et al., "Baby Sentry: A Smart Cradle," in 2024 ASU International Conference in Emerging Technologies for Sustainability and Intelligent Systems (ICETSIS), Manama, Bahrain, 2024, pp. 10841091.

[2] C. N. Savithri, S. Sumathi, M. Bhuvaneshwar, G. Dheepak and M. J, "Techno Cradle," in 2023 Intelligent Computing and Control for Engineering and Business Systems (ICCEBS), Chennai, India, 2023, pp. 15.

[3] P.Nazee, N. Suresh and B. V. Vani, "Revolutionary Baby Care Solution: Enhanced Cradle with Advanced Monitoring System," in 2023 14th International Conference on Computing Communication and NetworkingTechnologies (ICCCNT), Delhi, India, 2023, pp. 1-6.

[4] M. P. Joshi and D. C. Mehetre, "IoT Based Smart Cradle System with an Android App for Baby Monitoring," in 2021 International Conference on Computing, Communication, Control and Automation (ICCUBEA), Pune, India, 2021, pp. 1-4.

[5] S. S. S. Susarla, S. R. Sadaf, S. K. Harshitha and N. Vijapur, "IOT and Embedded Based Smart Baby Cradle," in 2023 International Conference on the Confluence of Advancements in Robotics, Vision and Interdisciplinary Technology Management (IC-RVITM), Bangalore, India, 2023,pp. 1-5.

[6] P. Kaitha, M. Gopi Krishna, R. Maadisetti and B. Kalva, "IoT based Smart Cradle System," in 2023 International Conference on Advancement in Computation Computer Technologies (InCACCT), Gharuan,India, 2023, pp. 664-667

[7] N. J. Kumar, H. R, A. N. Kumar, G. T, G. S and T. A, "A Lightweight (Recurrent Neural Network) RNN Architecture for IoT Based Baby Monitoring System to Provide Real Time Alerts and Notification to Parents or Care Takers," in 2023 Intelligent Computing and Control for Engineering and Business Systems (ICCEBS), Chennai, India, 2023, pp. 16.

[8] Thangam, S., Tejaswi, M., Supritha, V.,"Low Cost Precision Farming and Remote Monitoring Using Cloud",(2023) 2023 14th International Conference on Computing Communication and Networking Technologies, ICCCNT 2023

[9] N. L. Pratap, K. Anuroop, P. N. Devi, A. Sandeep and S. Nalajala, "IoT based Smart Cradle for Baby Monitoring System," in 2021 6th International Conference on Inventive Computation Technologies (ICICT),Coimbatore, India, 2021, pp. 1298-1303.

Authorized licensed use limited to: Amrita School of Engineering. Downloaded on December 19,2024 at 08:06:17 UTC from IEEE Xplore. Restrictions apply.

[10] H. Chauhan, D. Gupta, S. Gupta and M. J. Haque, ”A Smart Cradle System to Monitor Infants for Healthcare Baby Wards Based on IoT and Blockchain,” in 2021 3rd International Conference on Advances in Computing, Communication Control and Networking (ICAC3N), Greater Noida, India, 2021, pp. 606-609.

[11] A. R. Patil, N. J. Patil, A. D. Mishra and Y. D. Mane, ”Smart Baby cradle,” in 2020 International Conference on Smart City and Emerging Technology (ICSCET), Mumbai, India, 2020, pp. 1-5.

[12] S. Kavitha, R. R. Neela, M. Sowndarya, Madhuchandra and K. Harshitha, ”Analysis on IoT Based Smart Cradle System with an Android Application for Baby Monitoring,” in 2021 1st International Conference on Advanced Technologies in Intelligent Control, Environment, Computing Communication Engineering (ICATIECE), Bangalore,India, 2021, pp. 136139

[13] R. Sonia, S. M. Jayadeva, S. D. P. Ragavendiran, R. N, J. Arumugam and S. S. Kumar, ”IoT based Smart Cradle for Neonatal Monitoring,” in 2022 6th International Conference on Electronics, Communication and Aerospace Technology, Coimbatore, India, 2022, pp. 432-437

[14] S. Durga, S. Itnal, K. Soujanya, C. Z. Basha and C. Saxena, ”Advanced and effective baby care monitoring Smart cradle system using Internet of Things,” in 2021 2nd International Conference on Smart Electronics and Communication (ICOSEC), Trichy, India, 2021, pp. 35-42.

[15] Dandu, R., Thangam, S.,”IoT Based Single Axis Solar Tracker”,(2023) 2023 14th International Conference on Computing Communication and Networking Technologies, ICCCNT 2023

[16] S. Joseph, A. Gautham.J, A. Kumar and M. K. Harish Babu, ”IOT Based Baby Monitoring System Smart Cradle,” in 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2021, pp. 748-751.

[17] W. A. Jabbar, H. K. Shang, S. N. I. S. Hamid, A. A. Almohammedi, R. M. Ramli and M. A. H. Ali, ”IoT-BBMS: Internet of Things-Based Baby Monitoring System for Smart Cradle,” in IEEE Access, vol. 7, pp. 9379193805, 2019.

[18] Rajesh Kannan, M., Jyothsna, K., Aparna, T.S., Anjali, T., Meera, M., Amrutha, S.D. (2020). IoT-Based Women Security System. In: Ranganathan, G., Chen, J., Rocha, A. (eds) Inventive Communication and Computational Technologies. Lecture Notes in Networks and Systems,vol 89. Springer, Singapore.

Authorized licensed use limited to: Amrita School of Engineering. Downloaded on December 19,2024 at 08:06:17 UTC from IEEE Xplore. Restrictions apply.