2023 International Conference on Advancement in Computation & Computer Technologies (InCACCT) | 979-8-3503-9648-5/23/$31.00 ©2023 IEEE | DOI: 10.1109/InCACCT57535.2023.10141724

IoT based Smart Cradle System

Poojitha Kaitha
dept. of Electronics and Communication Engineering
Vardhaman College of Engineering (JNTUH)
Hyderabad, India
poojithakaitha@gmail.com

Gopi Krishna M
dept. of Electronics and Communication Engineering
Vardhaman College of Engineering (JNTUH)
Hyderabad,India
m.gopikrishna@vardhaman.org

Rohit Maadisetti
dept. of Electronics and Communication Engineering
Vardhaman College of Engineering (JNTUH)
Hyderabad,India
rg32683@gmail.com

Bhargav Kalva
dept. of Electronics and Communication Engineering
Vardhaman College of Engineering (JNTUH)
Hyderabad,India
kalvabhargav1234@gmail.com

***Abstract*— Certain cradles are created with Internet of things (IoT)' integration, but there are still some features that could be added to monitor the health of babies. Parents need to manage their professional work and also should take care of their children that increases the work load for the parent and effects their professional lives as well as their children's lives. So here we are adopting a modern-day cradle system due to the lack of features in traditional cradle systems. The proposed system allows mothers to manage both their career and personal lives. There is a need to build a smart cradle that will allow parents to focus on their work and provides minimal protection to their infants. The proposed method produces a system that is both safe and efficient.**

Keywords*— *Arduino Nano, Sound sensor, Web camera, Temperature and Humidity sensor, Wetness module,Blynk application.

I. INTRODUCTION

Everyone, even parents are consumed with their professional life in today's fast-paced society. They depart early and arrive back right before dinner . As a result, they are unable to take care of their children due to a lack of time.Not all people have the funds to pay a nanny to assist them with their offspring. Mother must manage the household while also caring for their children after putting in long hours at work .Therefore ,the world urgently needs a baby monitor that can keep a better check on baby's health.

A form of alarm system called a baby monitoring system can keep track of a baby's whereabouts and activities while also alerting the proper authorities. Families have impulses to protect their children from potential perils and risks since the beginning of time. The way parents raise their children has changed as a result of technological innovation. They are currently thinking about using engineering and technological advancements to gain advantages for their children's safety. A smart baby monitoring system may be a more affordable option now-a-days than enrolling children in day-care or employing a babysitter when parents are focused on their work. Continuously monitoring a newborn baby is a difficult task, as parents cannot be with their children all of the time,especially if they are working.

II. LITERATURE

Working parents find it challenging to care for their infants. System offers features like video monitoring and swings automatically when the baby screams. Additionally, if the mattress gets wet, a buzzer sound is made, alerting the parents via message and if the infant cries for a prolonged period, indicating that the system can't handle the infant and the infant demands personal attention.[2] Using a Pi Camera and Raspberry Pi, describes how to monitor a baby. The system's design enables it to recognize the cry sound and movement of a baby. With the use of a Pi camera, a condenser microphone is attached to detect an infant's cry sound and a passive infrared sensor detects the infant's movement.[3] "Intelligent infant monitoring system," is based on Global system for mobile communication (GSM)'. It can transmit data over a 'GSM' network while simultaneously keeping track of an infant's heart rate, body temperature, movement, and moisture content. This device isa peripheral interface controller 18f4520 of an 8-bit microcontroller that can control a buzzer, a liquid crystal display to display the sensor data and parents will get a text message.[4] When the system hears baby crying, it starts to swing and stops when the crying stops. The user's needs can be accommodated by adjusting the cradle's swinging speed. When two conditions are met, the system's built-in alarm alerts the user. An alarm sounds when the mattress becomes wet and alert you that it needs to be replaced. As a result, it only functions when parents are present at the cradle.[5] An oscillating bed, sensors, a link, and a dc motor are all included in the baby care equipment. The links will be activated by the electric motor's shaft. Links moves the rod that is connected to the bed at a steady pace. A vibratory motion will be produced by the springs that connect the carriage to the metal rod. Using sensors, it will also keep thecradle moving even when the baby cries or moves.[6] The proposed baby cradle's prototype was created using Nx Siemens software. The cradle uses a motor to swing automatically whenever the baby cries. The lullaby toy on the baby cradle can be turned on remotely via the message queuing telemetry transport server and parents can also use it to monitor their babies' health through an external web camera.[7] On a control chart, the motion of the baby is represented by points, if these change, the baby is acting abnormally. A warning message is sent to

ISBN: 979-8-3503-9648-5/23/$31.00 ©2023 IEEE

baby sitters, when such behaviour is noticed. The suggested framework can be used to keep an eye on a baby whether they are at home or in a child care facility.[8] The Design of system aims to assist parents to keep an eye on their child while they sleep and to improve the quality of the child's sleep by remotely monitoring the room's conditions.

III. DESIGN

Arduino Nano digital pin D4 is connected as input to digital temperature and humidity(DHT)'11 sensor. The digital pins D8,D10 are connected as outputs to fan and servomotor respectively. The analog pins of Arduino Nano A0,A1 are connected as inputs to Wetness sensor and Sound sensor respectively. The Node microcontroller unit(MCU)' digital pins D0,D1 are connected to digital pins D0,D1 of Arduino Nano for interfacing.

The Arduino Nano and the Node 'MCU', which has in-built wireless fidelity(Wi-Fi)', have been combined.It monitors various interruptions such as a baby cry sound, baby temperature and dampness conditions. The cradle swings on its own if a baby cries non-stop. If the temperatureof a baby rises above 28 degree Celsius, the fan will turn on. If the mattress becomes wet, a buzzer sounds. Parents are informed of all of these conditions. The device also offers on-demand live feeds of the baby camera, allowing parents and guardians to observe what their children are up to in the cradle at any moment. All of these conditions are alerted to parents via the Blynk application.

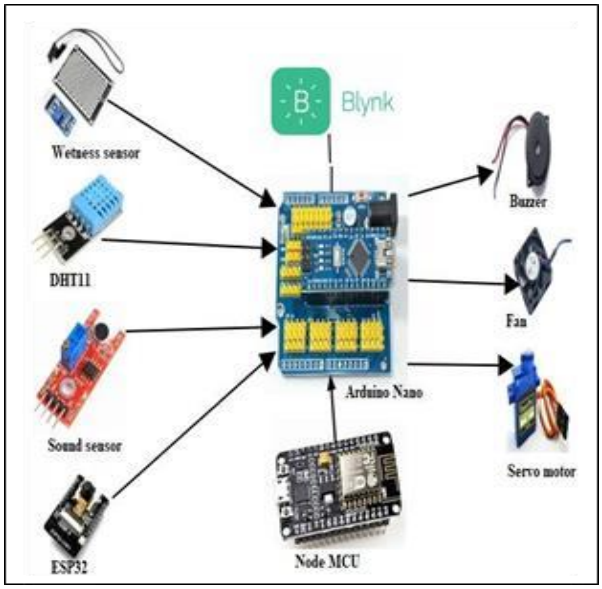

Fig. 1. Block Diagram

A. *Node 'MCU'*

Node 'MCU' hardware is open-source, thus anyone can modify or design it. The Espressif systems (ESP)'8266 'Wi- Fi' capable chip is used in the Node 'MCU' Development kit. The 'ESP'8266 is an internet protocol- based chip that was created by 'ESP'. The analog(A0) and digital (D0-D8) pins on the board of the Node 'MCU' development kit are identical to those on an Arduino. Various communication protocols are supported by Arduino. Lua scripts are commonly used to program the Node 'MCU' with the 'ESP'lorer integrated development environment. Arduino programming environment can be used to create Node 'MCU' applications.

B. *Arduino Nano*

A 16Megahertz crystal oscillator is a component of the Arduino Nano. Arduino Nano, with constant voltage,a precise clock is created. One constraint of the Arduino Nanois that a battery can't be used to power it because it lacks a DC power port. The Arduino software can be used to program an Arduino Nano. Nano board must be selected from tools menu. The Atmel mega328 microcontroller on the Nano board comes pre-programmed with a boot loader.

C. *'DHT' 11*

The 'DHT'11 is a cheap instrument that measures temperature and humidity. To measure humidity and temperature in real-time, a microcontroller like an Arduino, Raspberry Pi, or another can simply communicate with this sensor. The electrical resistance between two electrodes is examined by the 'DHT'11 to determine humidity levels. The temperature of the air is measured using a thermocouple or a surface-mounted negative temperature coefficient.

D. *LM393 Sound Sensor*

The single-channel sensor module known as the LM393 Electret Microphone Module uses the LM393 as its main operational amplifier. The three pins of an LM393 module are an output, ground and voltage common controller. When it detects nothing, the output pin is high. Any time it senses sound around it, it lowers. The output pin is connected either directly to a 5 volts relay or to the digital pin of the microcontroller board.

E. *Wetness Sensor Module*

Wet detection is carried out by using Wetness Sensor Module. There are two primary components the module. A printed circuit board with a group of copper cables serves as the primary component. This board's total resistance is lowered when water droplets fall on it as several copper routes get linked to one another. A board that transforms analog signal to digital signal serves a second component.

F. 'ESP'32 Camera

A tiny camera module built on the 'ESP'32 platform; the 'ESP'32 camera uses very little power. It includes an OV2640 camera and an internal trans flash card slot. The 'ESP'32-camera is a versatile 'IoT' platform, which can be applied to a variety of cutting-edge 'IoT' applications 'Wi- Fi' picture upload, quick response identification, wireless video monitoring, and more.

IV. IMPLEMENTATI

ONThere are four operations in this

project:
1) 'ESP'32 is used to keep an eye on the infant.
2) Monitors temperature of baby.
3) Detects baby cry sound.
4) Keep an eye on humidity.
5)

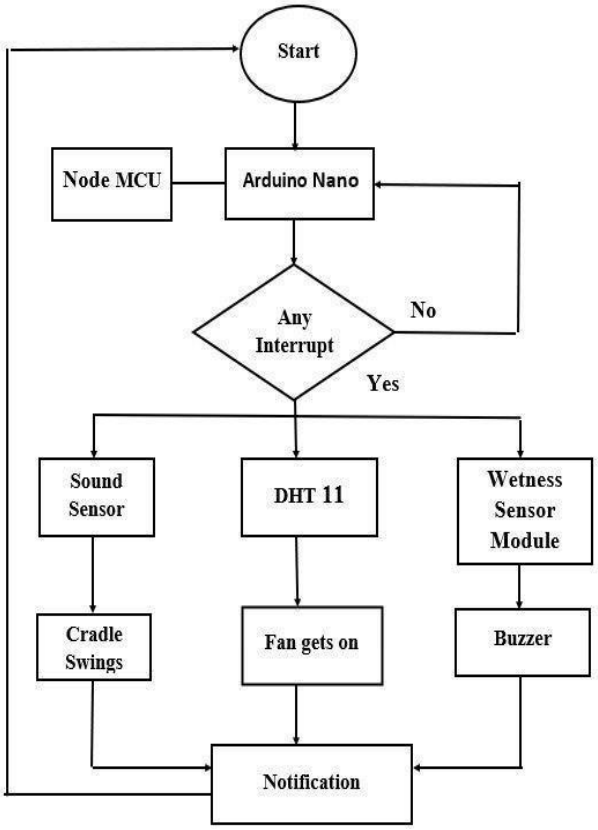

Fig.2. Flow chart of proposed model

When the kit, which connects Node 'MCU' and Arduino Nano, turns on. It simultaneously checks for any interruptions, such as a baby's cry sound, temperature, and dampness. The sound sensor recognizes baby's repeated screams and immediately swings the cradle using the servo motor to notify the parents via a notification Alert! Baby is crying. When the temperature rises above 28 degree Celsius,the fan activates and sends a notification to parents Alert! Fan has been turned on because the temperature is too high. When the mattress is wet, the buzzer activates and alerts the parents with a notification Alert! Wetness detected. Through 'ESP'32 camera, the baby is constantly observed.

The Blynk application manages all of these settings. The Blynk application which interfaces with the sensors, store and saves data, display it in the app continuously. We may construct a project dashboard and add buttons, sliders, graphs and other widgets to the display after downloading the Blynk application. Pins can be turned on and off with the use of widgets, which can also show sensor data. The platform is made up of three main components: Using a range of widgets we provide, Blynk App- enables us to create beautiful user interfaces for your projects. The responsibility for managing all communications between the hardware and the smartphone rests with the Blynk Server. Blynk Libraries handle all incoming and outgoing commands and facilitate communication with the server on all widely used hardware platforms. However, the software side of Blynk is simpler than the hardware. For easy project connections, Blynk application works well.

V. RESULTS

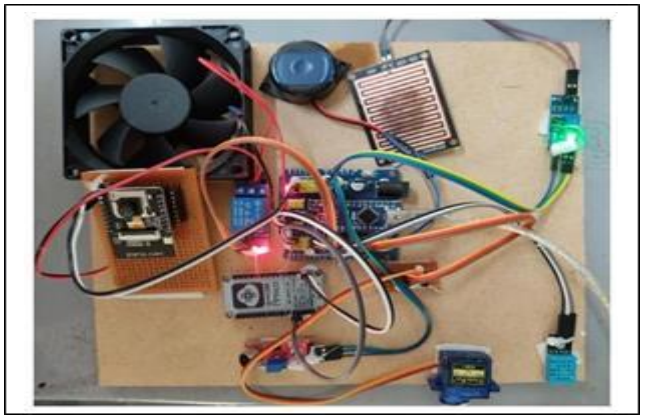

Fig.3. Prototype

Hardware elements LM393, Wetness module sensor, 'ESP'32 camera, and 'DHT'11 sensor are inputs. Mini fan, buzzer and servomotor are the outputs. Using Arduino Nano, which interfaces with Node 'MCU, inputs and outputsare connected.

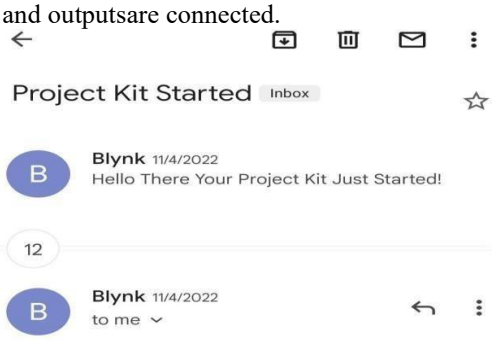

Fig.4. Kit start notification

The kit sends a notification as soon as it is turned on, as it has just begun. Later, it checks for parallel interrupts.

When the mattress gets wet, a buzzer sounds and an alertis sent to the parents.

VI. CONCLUSIONS

Fig.5. Cry alert

When a baby cry is detected, the cradle swings automatically and notifies the parents.

Fig.6. Temperature alert

If the temperature rises above 28 degree Celsius,fan turns on and sends an alert to the parents via Blynk application.

Fig.7. Wetness alert

A baby's vital signs, including temperature, humidity and how often they cry are monitored by an 'IoT' based smart cradle system. Because it has an inbuilt 'Wi-Fi' module that enables the development of the 'IoT' concept, the Node 'MCU' was chosen as the main controller board in the project's circuit design. The completed prototype was evaluated on a phone that played a baby crying ringtone. After the phone briefly rang, the cradle began to swing as the system determined the baby was crying as a result of the noise. An alert was sent to the user's phone to let him or her know the infant was sobbing. Temperature and humidity levels in the area were recorded. The tiny fan gets on whenever the temperature climbed above 28 degree Celsius and a siren is produced, when moisture was found. The user of the smartphone camera app can monitor the infant. We will use 'IoT' to build a cradle system that will reduce stress for parents and offer a secure environment for the new-born in terms of both time and security.

VII. FUTURESCOPE

The smart cradle system is a project that includes functions like video monitoring, baby cry detection, temperature monitoring and wetness monitoring. Whether they are bored, hungry and sick, babies are unable to communicate their feelings or discomforts. They are unable to convey their pain in any other way except by crying. Thebaby needs to be instantly fed withfood when they start crying, acknowledging it to be a hunger cry. We could also include function of music and toys being played when they sober.

REFERENCES

[1] M. P. Joshi and D. C. Mehetre, "IoT Based Smart Cradle System with an Android App for Baby Monitoring," 2017 International Conference on Computing, Communication, Control and Automation (ICCUBEA), 2017, pp. 1-4, doi: 10.1109/ICCUBEA.2017.8463676.

[2] A. F. Symon, N. Hassan, H. Rashid, I. U. Ahmed and S.M. Taslim Reza, "Design and development of a smart baby monitoring system based on Raspberry Pi and Pi camera," 2017 4th International Conference on Advances in Electrical Engineering (ICAEE), 2017,pp. 117-122, doi: 10.1109/ICAEE.2017.8255338.

[3] S. P. Patil and M. R. Mhetre. "Intelligent baby monitoring system". In: International Journal of Research in Advent Technology,www.ijrat.org. Vol. 9. 2019, pp. 191–194. doi: 10.32622/ijrat.76201981.

[4] M. Goyal and D. Kumar. "Automatic E-Baby Cradle Swing based on Baby Cry". In: International Journal of Computer Applications 71.21 (2013). Full text available, pp. 39–43.

[5] T. P. Patekar, P. S. Dawale, and P. A. Jaiswal, "Design and fabrication of automatic baby cradle system," *International Research Journal of Engineering and Technology (IRJET)*, vol. *5, no.* 02, pp. 117– 122, 2018.

[6] W. A. Jabbar, H. K. Shang, S. N. Hamid, A. A. Almohammedi, R. M. Ramli, and M. A. Ali, "IoT-BBMS: Internet of Things-based baby monitoring system for smart cradle," *IEEE Access*, vol. *7*, pp. 93791-93805, 2019.

[7] T. Hussain, K. Muhammad, S. Khan, A. Ullah, M. Y. Lee, and S. W. Baik, "Intelligent baby behavior monitoring using embedded vision in IoT for smart healthcare centers," *Journal of Artificial Intelligence and Systems*, vol. *1, mo.* 1, pp. 110-124, 2019.

[8] B. Irawan, Y. Yulhendri, K. Kartini, N. Anwar, B. Tjahjojo, and A. S. Meganingrum, "Design And Development Of A Baby Sleep Monitoring System Based On Internet Of Things (Iot)," *International Journal of Science, Technology & Management*, vol. *3, no.* 4, pp. 835-844, 2022.

[9] A. Kaur and A. Jasuja, "Health monitoring based on IoT using Raspberry PI," In *2017 International conference on computing, communication and automation (ICCCA)* (pp. 1335-1340). IEEE, May 2017.

[10] P. Bhasha, T. Pavan Kumar, K. K. Baseer, and V. Jyothsna, "An IoT-based BLYNK server application for infant monitoring alert system to detect crying and wetness of a baby," In *International Conference on Intelligent and Smart Computing in Data Analytics: ISCDA 2020* (pp. 55-65). Springer Singapore, 2021.

[11] A. R. Patil, N. J. Patil, A. D. Mishra, and Y D. Mane, "Smart Baby cradle," In *2018 International Conference on Smart City and Emerging Technology (ICSCET)* (pp. 1-5). IEEE, Jan 2018.

[12] , V. S. Kumar, L. Pullagura, N. V. Kumari, S. Pooja Nayak, B. P. Devi, A. Alharbi, and S. A. Asakipaam, "Internet of Things-Based Patient Cradle System with an Android App for Baby Monitoring with Machine Learning," *Wireless Communications and Mobile Computing*, *2022*.

[13] S. Kavitha, R. R. Neela, M. Sowndarya, and K. Harshitha, "Analysis on IoT based smart cradle system with an Android application for baby monitoring," In *2019 1st International Conference on Advanced Technologies in Intelligent Control, Environment, Computing & Communication Engineering (ICATIECE)* (pp. 136-139). IEEE, March 2019.

[14] C. P. Pramod, K. G. Pramod, and B. A. Anil, "Development of an Intelligent Baby Cradle for Application at Home,".

[15] C. T. Chao, C. W. Wang, J. S. Chiou, and C. J. Wang, "An arduino-based resonant cradle design with infant cries recognition," *Sensors*, vol. *15, no.* 8, pp.18934-18949, 2015.