Monitoring system for the baby using wireless sensors and camera

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ABSTRACT: Working women' responsibilities for child care baby have grown more complex in recent years. When working women are at home, they will not have the time to constantly supervise their children(babies). They either hire a babysitter or send the kid to their grandparents' place to take care of the child. A warning message will be sent to both the caregiver and the parents if the results are out of the ordinary. Motion Eye OS can keep tabs on the baby's prance. The prototype of a baby monitoring system saves time for parents and makes life easier for those who provide care for the little ones. This newborn monitoring device has been shown to be the safest and most accurate for the infant. This IoT-based real-time monitoring system has the greatest security protections in the industry.

I. INTRODUCTION

In recent years, it has become more typical in India for both parents to work. Working parents' biggest challenge right now is keeping an eye on their children. While they can have a caretaker for the infant, it would be challenging and difficult for them to keep an eye on the baby's health and well-being. As a result, about one in ten babies are born prematurely. When a baby is born prematurely, it is more vulnerable than a normal-born child. Premature babies have a hard time adapting to their new surroundings, both at home and in the hospital. More than three weeks before the expected due date, a baby is said to be prematurely born. They're more likely to have health problems and be at greater danger of death. Every second and every now and then, the baby's condition must be checked on. They'll be monitored minute by minute in a solitary chamber or incubator.

A preterm infant will spend more time in the hospital's neonatal intensive care unit or nursery than a term infant would (NICU). Premature infants often have low blood pressure and respiratory distress syndrome (PDA) due to their underdeveloped respiratory systems (hypotension). In addition, kids suffer from hypothermia since their immune systems are still developing. Studies show that almost 4 million infants globally die at a young age due to complications associated with their low birth weight. A lack of oxygen causes babies to suffocate under high temperatures and humidity. The health of the new born is further jeopardized by these issues. Similarly, after a preterm infant's time in the hospital is through, they will need to be cared for at home. Caregivers and parents alone are unable to satisfy a baby's demands. In most hospitals, an incubator will keep track of every vital sign, temperature, and ventilation rate, among other things, that pertain to a baby's health. At home, the baby's health and safety may be regularly monitored and supervised in a more child-friendly setting. [1].

The advanced baby monitoring device aids working parents in keeping a check on their youngsters from afar. While several tools exist to aid with newborn monitoring, many of them fall short of expectations. As a result, this project's objective is to create a cheap system with high-quality capabilities. The term "Internet of Things" (IoTs) is often used to refer to a network of interconnected electronic devices and everyday things. It makes it simple for a wide variety of devices to send and receive data over the internet. The goal of this study is to use the Raspberry Pi microcontroller, a powerful IoT device, to build a smart newborn monitoring system. This is because real-time monitoring is one of the most important tasks for IoT. In particular, a camera, and a sensor for assessing ambient will be used to keep tabs on the infant. Designing a system that permits and provides high-quality monitoring would be a significant issue. [2] In this way, parents may save time and effort by not having to repeatedly check on their child if no new information is being provided. To implement this situation, we need sensors and a CPU. The microprocessor is equipped with sensors that detect environmental conditions and track the baby's movements. To some extent, its usefulness depends on the specific

circumstances in which we use it. The user will have access to all relevant information and get updates on the baby's health at all times. [3]

II   REVIEW OF LITERATURE

(HandeAlemdar, 2010) [4] Computer science and healthcare application industries see wireless sensor network technologies as an important research field that can be exploited to improve the quality of life. Healthcare systems that are widespread give a wealth of contextual information and alarm mechanisms for unusual circumstances. As a result, the number of caregivers is reduced, the chronically ill and old are given a better quality of life, as well as babies and small children whose parents are both working are given excellent care. The area, despite its many advantages, still faces substantial obstacles, which are examined in this research.

(Dubey, 2019) [5] This paper presents an image-processing-based, non-contact baby monitoring system that busy parents may use to maintain tabs on their child's whereabouts and activities. The gadget records the infant's head position, cry frequency, and movement. If the system notices anything out of the ordinary, it will send the user an email with baby pictures and videos. Image processing is used to identify real-time infant mobility and the boundary conditions of the bed, while the Raspberry Pi B+ module processes recordings from the Pi camera, the MIC is used to detect crying, and the MIC is used to detect crying. OpenCV, Numpy, and a Virtual Environment (VE) had to be installed before the operating system Raspbian could be installed. The Haar classifier is used to train a face detection algorithm for both positive and negative face images. The baby's risk of falling from the bed will be reduced by this arrangement. While the baby is resting, this method can be employed in hospitals to relieve the stress of nurses..

(Liu, 2014) [6] Continuous monitoring of newborn health has been possible because to advances in wearable sensor technologies, wireless connection methods, and a low-energy-consumption microprocessor equipped with high-performance data processing algorithms. As a diagnostic tool, newborn wearable sensor devices may send data collected from the child's internal organs to doctors and parents. External dangers, like as falls or drowning, may also be detected by these gadgets and an immediate alarm sent to the parents. After reviewing a few current wearable sensor systems for newborns, this paper goes on to describe various framework components found in these systems and then provides an overview of the various approaches used in these here are concerned with the respective project in review kind completion of each of those phases which is work premeditated as finalized. Wearable sensor systems. In this paper, the most recent research and achievements are discussed, as well as the practical applications in healthcare and behaviour analysis. In addition, we provide a clear picture of the future development of newborn sensor systems that can be worn.

(Vignesh Ravichandran, 2021) [7] Preterm births are on the rise, putting them at greater risk for serious health problems. NICUs are required for these infants' continual care (NICU). Premature neonates in the neonatal intensive care unit (NICU) are constantly monitored by a series of hooked, adhesive electrodes connected to their bodies. There is a risk of skin damage, discomfort, and irritation to the newborn if medical adhesives are used on the electrodes. Furthermore, because RR is derived from an EKG, RR monitoring in the NICU is fraught with difficulties in terms of accuracy and clinical quality (ECG). A smart textile pressure sensor system has been designed and tested to meet the current issues of medical monitoring in neonatal intensive care units (NICUs).

(Kaichen Xu, 2021) [8]Human lives can be saved by the development of feedback systems that track physical states. It is common for vulnerable populations including those with disabilities and the elderly to require additional attention and care. Since SIDS is a leading cause of infant mortality worldwide, special care must be taken with newborns either in neonatal intensive care facilities or in ordinary life. This paper describes a system that uses integrated flexible sensors based on laser-induced graphene (LIG) to remotely monitor a baby's sleeping positions, breathing rate, and diaper wetness, and to send back alert signals. At least 18 different slanting orientations can be tracked by a tilt sensor that uses a liquid metal droplet in a hollow.

(Shamim YousefiDerakhshan, 2019) [9] As multiagent systems in wireless sensor networks improve in effectiveness, researchers are increasingly turning to these new mobile software packets for usage in both simulated and real-world scenarios. Multiagent systems could connect heterogeneous and distributed wireless sensor networks to map real-world problems onto the artificial intelligence realm.

(Mahaseth, 2022) [10] There has been an increase in the amount of time that physical monitoring of a critically unwell infant is limited. Sudden Infant Death Syndrome (SIDS) affects a large number of newborns and infants, causing uncertain death (SIDS). An intelligent newborn monitoring prototype developed in this work includes both software and hardware components, such as sensors, to address this problem.

(S, 2021) [11] The acknowledgement of the Internet of Things (IoT) in the present world is a result of the proliferation of cell phones and the internet (IoT). Working mothers using their cell phones to keep an eye on the baby's cradle is one such example. It is designed to minimise the likelihood of a baby crying when a sound is detected. Initially, the cradle swings automatically when a baby's cry is recognised. When a baby's cry sound cannot be controlled for an extended period of time, it requires immediate personal treatment.

III PROPOSED SYSTEM

Sensors is both incorporated into this system, resulting in accurate data about the health of the baby. We also use a camera from a Wide Area Network (WAN) to monitor the children and regulate the situation from a distant location. Infant monitoring can be safe, cost-effective and easy to use if a moisture sensor is employed. Analyzing the baby's environment for NH3, smoke, and CO2. The baby's fall from the crib is detected using a Wireless Camera.

OBJECTIVES:

- Analyzing the moisture condition through moisture detection sensor.
- To determine the smoke, steam and harmful gases through gas detection sensor.
- Monitoring the baby through camera based on image processing.
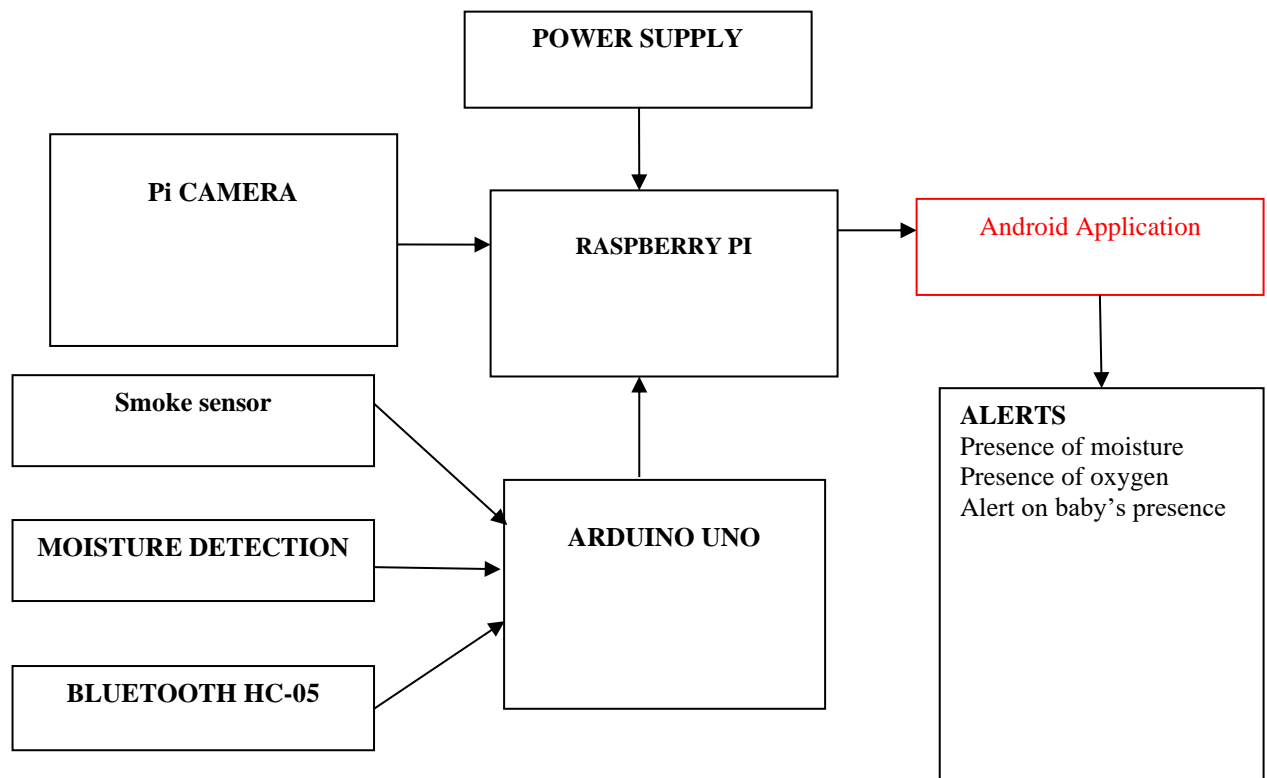- To develop an android application to alert the parents.

VI   METHODOLOGY

Figure 1: Block diagram for proposed system

V IMPLIMENTATION

A. CONFIGURATION OF SENSORS:

Once a Device has been added, a Sensor Configuration tab will be immediately created and populated with relevant sensors. Additional setting could be necessary for certain sensors. Jumper wires may be used to connect the gas sensor for detecting harmful gas, Bluetooth device, and moisture sensors to the Arduino Uno.

Figure 2: Integration Arduino uno and Sensors

B. CONFIGURATION OF Pi CAMERA

In order to alert the Raspberry Pi when a newborn starts to cry, a condenser microphone will be used in this project. Another innovative feature of this technology is the camera it includes to record the baby's environment. The Raspberry Pi Camera Module, an official accessory for the Raspberry Pi, will be connected through one of the two small ports on the top surface of the board. The Raspberry Pi's built-in camera module allows for the recording of high-definition video, time-lapse video etc. It provide a live video feed of the children's present condition to frantic parents, reassuring them of their children's safety.
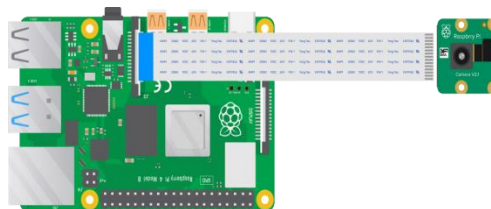
Figure 3: Integration Raspberry pi and Pi-camera Merging of Microcontrollers:

Using an Arduino uno cable, connect the raspberry pie to the Arduino uno. Expansion boards were used since the Raspberry Pi Model B lacks enough USB ports for a keyboard, mouse, a Wi-Fi dongle, and an Arduino; hence, they were needed. Because it has a converter and a VNC viewer, the expansion board provides and it will display the output. A real-time clock and power supply are also included. It has been reported that a Wi-Fi dongle is utilized, which opens up the possibility of connecting to WLANs and the internet. Wi-Fi dongle model TL-WN722N is authorized by the Raspberry Pi community for Raspbian compatibility. A USB type A to B connection is used to link the Arduino UNO to the computer; the entire arrangement is shown in Figure 1. The connections between the Raspberry Pi and the Arduino

are colored blue and red, respectively. Moisture Sensors, Mq1335 sensors, HC-05, Raspberry pi are examples of the types of sensors that may be used with Arduino. Next, the operating system for the Raspberry Pi must be installed.
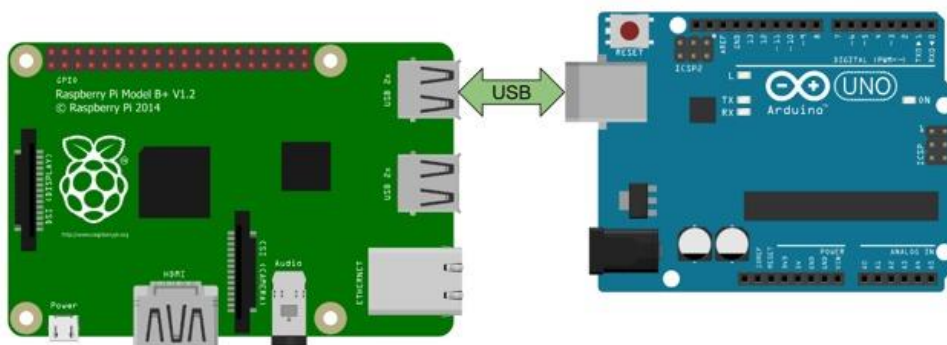

Fig 4: Integration of Raspberry pi and Arduino uno

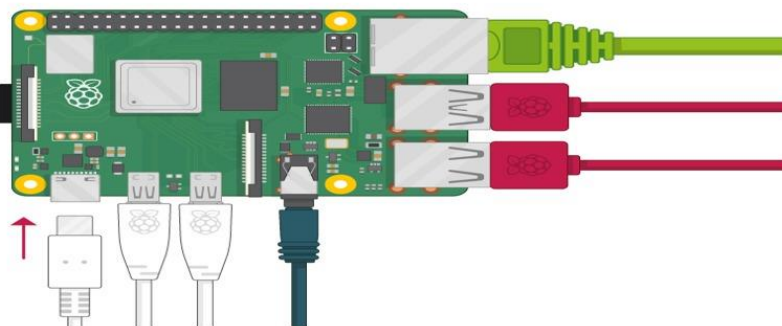**Pi should be powered by an AC adapter, so do this**

Fig 5: Integration Raspberry pi and power adapter

Use of arduino uno in baby monitoring system :

The Arduino Uno is a popular piece of hardware in the Arduino line up. Low cost, easy availability, and small size make it ideal. USB to serial chip on board allows us to put code into the on-board atmega328 controller quickly.

Use of cradle in baby monitoring system:

The smart baby cradle makes it easier for working moms to juggle work and home responsibilities. In addition, the newly automated cradle offers parents a slew of useful additional capabilities. Even if they aren't at home, parents can keep tabs on their child in real time.

Use of Gas Sensors in baby monitoring system

1. Monitoring of oxygen level is very important with safety point of view.
2. Gas Sensors are used in monitoring the harmful gas around the baby.
3. harmful gas flow consistency around the crib or surrounding of the baby. harmful gas flow consistency.
4. In addition to this, it is described as being nothing more than a Gas Sensor in the style of metal oxides and metals.
5. A network of straightforward voltage splitters may, in fact, be used to determine the concentration of a gas.
6. The smoke sensor has a built-in potentiometer that allows you to adjust the sensor sensitivity according to how

accurate you want to detect gas.

Use of Raspberry-pi in baby monitoring system

The Raspberry Pi is a small, inexpensive computer the size of a credit card that connects to a computer display or TV and operates with a regular keyboard and mouse. With the help of this competent small gadget, individuals of all ages may learn about computing and how to write in languages like Scratch and Python. Several authorized Raspberry Pi camera modules are available. There are variants for both iterations in infrared and visible light. In 2020, a high-resolution 12-megapixel camera was introduced.

Use of pi-Camera in baby monitoring system:

There are four components to the whole control system: The Raspberry Pi B+ (pi-camera) a condenser that picks up baby's preance that tracks movement, and a Pi camera that takes pictures of the baby's preance. It will be possible for any device on the Wi-Fi network to see the video transmitted by the Pi-Camera. Based on the Raspberry Pi microcontroller, a camera-based baby monitoring system that is designed to keep an eye on the child.

VI. RESULT

The baby's Bluetooth device is linked and showing his or her current status.
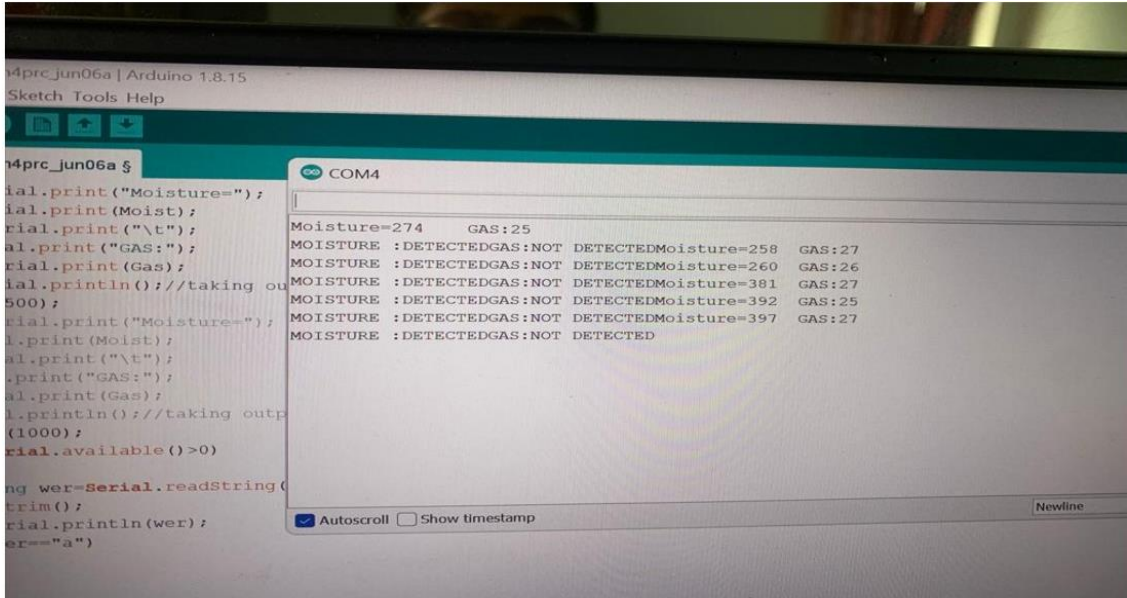

Figure 6: Presence condition of the infant

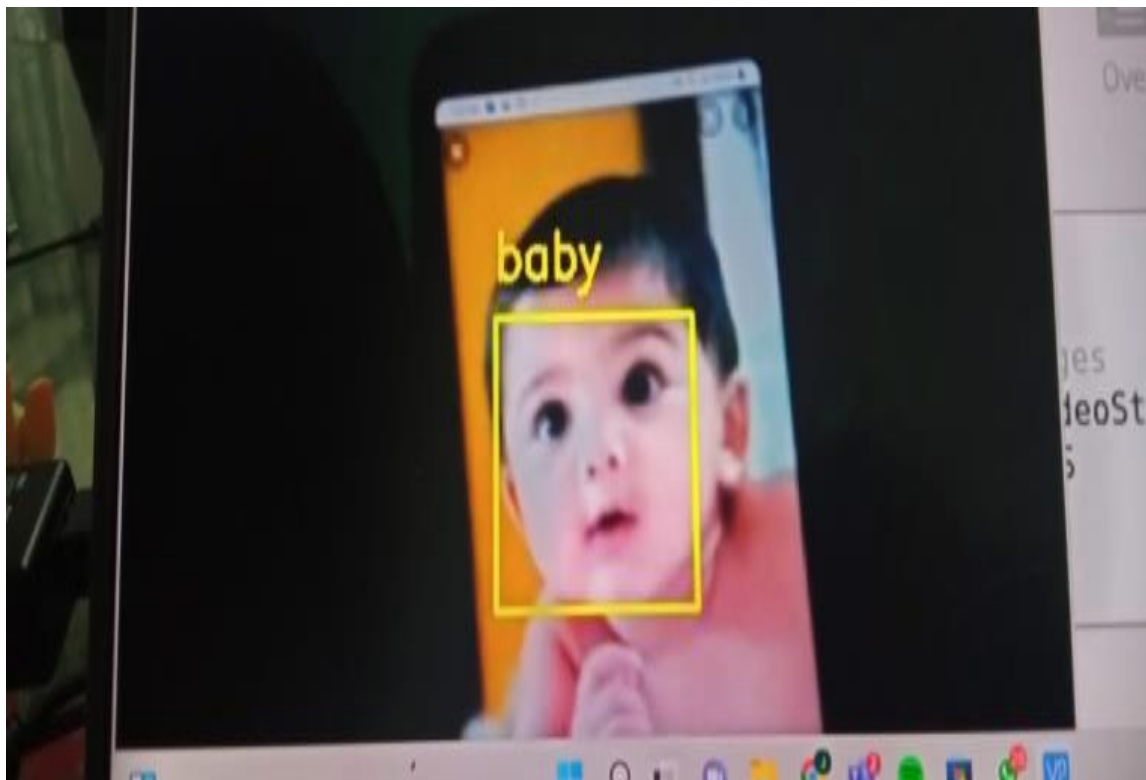**Figure 7: Output Displayed on the serial Monitor**

Figure 8: Baby presence detected

Figure 9: Harmful Gas detection

VII CONCLUSION

Parents will be able to see their Infants using this baby monitoring device. This system's primary benefit is that it is easier to use and poses no risk to the infant. This project's goal, as we briefly touched on in the introduction, is to create an infant monitoring system that is as safe as possible. That's why we went for video monitoring for the sake of our baby's safety, because it's a first for us. During this study, a baby-monitoring device was developed that can identify a presence. It relying on a microcontroller or an Arduino, this system is powered by a Raspberry Pi B+ (pi-camera) module. As well as at the hospital or in the care of an infant, it may be used in a variety of contexts. The design approach is simple to execute and may be tailored to meet the needs of the end user. It would be easier to monitor the infant if numerous sensors are integrated with Arduino Uno . In this implementation Gas Sensor, MQ135, Bluetooth module HC-05 and pi-camera is used. It is an analog gas sensor, which can detect smoke, methane and other dangerous and flammable gases. The PI camera is activated, and an image of the infant is captured and forwarded to the share live video of the baby which is displayed by VNC player. The idea of a camera connected to raspberry-pi and operated by the arduino itself is useful for monitoring newborns. Working parents will benefit from the module's implementation since it makes it easier to keep tabs on their infants. System for monitoring a newborn in the absence of the parents and presence caregivers is proposed here. The infant is monitored with a Pi-Camera, moisture sensor and a gas sensor.

REFERENCES

[1]   N. L. et. a. N Lakshman Prata Prata, "IoT based Smart Cradle for Baby Monitoring System," *IEEE Xplore*, 2021, [Online]. Available: file:///C:/Users/abc/Downloads/IOT smart cradle for baby Monitoring(2021) (1).pdf

[2]   D. M. Ibrahim1 and M. A. A. H. Et.al, "Raspberry Pi-Based Smart Infant Monitoring System," *Int. J. Eng. Res. Technol.*, vol. 12, 2017, [Online]. Available: https://www.ripublication.com/irph/ijert19/ijertv12n10_15.pdf

[3]   I. R. J. of E. and T. (IRJET), "IOT BASED BABY MONITORING SYSTEM USING RASPBERRY PI," *Int. Res. J. Eng. Technol.*, vol. 08, no. 03, 2021, [Online]. Available: https://www.irjet.net/archives/V8/i3/IRJET-V8I3200.pdf

[4]   HandeAlemdar, "Wireless sensor networks for healthcare: A survey," *Sci. direct*, vol. 54, no. 15, 2010, [Online]. Available: https://www.sciencedirect.com/science/article/abs/pii/S1389128610001398

[5]   Y. Dubey, "Baby Monitoring System using Image Processing and IoT," *Res. gate*, 2019, [Online]. Available: https://www.researchgate.net/publication/335927439_Baby_Monitoring_System_using_Image_Processing_and_IoT

[6]   Z. Z. Liu, "Wearable Sensor Systems for Infants," *mdpi*, 2014, [Online]. Available: https://www.mdpi.com/1424-8220/15/2/3721

[7]   M. J. S. Vignesh Ravichandran, "An E-Textile Respiration Sensing System for NICU Monitoring: Design and Validation," *springerlink*, 2021, [Online]. Available: https://link.springer.com/article/10.1007/s11265-021-01669-9

[8]   Y. F. Kaichen Xu, "A Wearable Body Condition Sensor System with Wireless Feedback Alarm Functions," vol. 33, no. 18, 2021, [Online]. Available: https://onlinelibrary.wiley.com/doi/abs/10.1002/adma.202008701

[9]   F. Shamim YousefiDerakhshan, "A review on the applications of multiagent systems in wireless sensor networks," *Int. J. Distrib. Sens. Networks*, 2019, [Online]. Available: https://journals.sagepub.com/doi/full/10.1177/1550147719850767

[10]   P. B. & R. Mahaseth, "A Wearable Infant HealthCare Monitoring and Alerting System Using IOT," *SPRINGER LINK*, 2022, [Online]. Available: https://link.springer.com/chapter/10.1007/978-981-16-5529-6_67

[11]   V. C. N. S, "IoT based Smart Baby Monitoring," *IEEE Xplore*, 2021, [Online]. Available: https://ieeexplore.ieee.org/abstract/document/9532997