Wireless Baby Monitoring System Using Arduino

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Abstract- *This paper presents the design and implementation of smart baby cradle system, a new low-cost baby monitoring system with multiple automatic functions. The system allows the cradle to swing automatically when baby cries. It has a cry analysis system which detects crying voices using sound sensor and automatically swings the cradle till the baby stops crying or zero voice detection. The system also has built-in fan that switched on when an increase in surrounding temperature is detected by DHT11 sensor. If the cradle is to be used manually, the speed of the cradle can be controlled as per the user need. Arduino Uno module is utilized in managing all the connected electronics components. This system aids parents and caretakers to look after the babies without high- demand physical attention. The smart baby cradle proposed in this paper in corporate few useful functions. First, the use of noise sensor for the detection of the child's crying activity. This will start the swinging of cradle to soothe the child. Next, the DHT sensor detects the surrounding temper- atureand humidity. When the detected temperature is higher than the set temperature i.e room temperature ,the fan will automatically switch on*

Keywords- Soundsensor,DHT11,ArduinoUno,servomotor, monitoring system

I. INTRODUCTION

In today's fast-paced society, it is a challenge for parents to look after their children especially after lengthy working hours. Kids especially babi es require full attention and monitoring most of the time including during parent's nighttime. There have been numerous advancements in infant-care technology that are intended to make it easier for parents to care for their children including the implementation of Internet of Things (IoT) into the system. Specifically on cradle design, many cradles design in current mar- ket incorporates latest technology with improved ef- fectiveness and innovation to cater this issues. There are several approach and research done by others prior to this design project. Similar concept is applied which is to give adequate assistance for infant care. Firstly, Mohamad Ishak et al. proposed an infant monitoring and alert system used in an incubator for neonatal intensive care unit (NICU) at hospital. The system helps the hospital personnel to monitor and record real-time conditions of the babies in NICU such as the incubator's temperature, humidity, and the baby's pulse rate. These measurement results are processed by Arduino microcontroller before being sent to PC for continuous monitoring. In case of ir- regularity in data readings, hospital personnel will be alerted to cater the issues. This helps in improving the productivity and efficiency in hospital

II. PROPOSED SYSTEM

A baby monitoring system using Arduino can be made up of an Arduino board and several sensors that can measure and report on the baby's condition.

Here are some components that can be used to make a baby monitoring system using Arduino:

- DHT11 sensor: This sensor detects the tem- perature and humidity of the baby's room.
- MIC sensor: This sensor detects the baby's crying sound.
- MEMS sensor: This sensor detects the ba- by's body movement.
- Pulse rate sensor: This sensor detects the ba- by's heart rate.
- Camera: This sensor allows parents to moni- tor the baby's activities and emotions.
- Cradle: This can be swung remotely to calm the baby down.
- Alarm system: This alerts the parents when the baby is crying or when the baby's condi- tion is abnormal.
- LCD display: This displays the baby's con- dition.
- Mobile phone: This is used to send text mes- sages to the parents when the baby is crying.

The Arduino board reads the data from the sensors and sends it to the PC for continuous monitor- ing. The Arduino board can also be used to control the cradle and the alarm system.

The proposed baby monitoring system is convenient for hearing impaired parents to aid their child. It is also accurate and can improve the performance of the health monitoring system

III. SYSTEM DESCRIPTION

The Arduino microcontroller is interfaced with input from the temperature sensor and heart- beat sensor. It sends that data through a Wi-Fi module to a web-based server to show constant real-time data from different sensors regarding the baby. If heartbeat or temperature is above or below a preset value, it will be displayed instantly on the website, and the website will command the buzzer and bulb accordingly. Finally, the proposed baby monitoring design will make it easier to efficiently supervise the affected baby incubator if more than one incubator is present. mobile application-based system that shows a constant update of a baby placed in their smart cradle system. The system can detect if the mattress for the baby is wet or not by using a moisture sensor. It can identify the baby's crying with a noise sensor and contains a camera for live-streaming to the app. The cradle also swings au- tomatically when crying is detected with the help of a driver circuit. Finally, the authors have also pro- posed using IR cameras for night vision as a future scope for advancement. The paper is based on taking care of multiple babies, which includes a database system. The proposed system measures various physiological signals of the baby, for example, blood oxygen saturation, heart rate. The device uses temperature sensing, humidity sensing circuits, and a sound capture circuit with a vibration sensor, determining the baby's crying. In PC, this system uses a graphical programming language to con- struct a monitoring screen. Finally, the obtained data are sent through a wireless system in real-time to the concerned persons. In essence, there are sev- eral research papers on baby monitoring systems, but to the best of our knowledge, none of them have implemented integrated facial recognition capabil- ities to identify a baby uniquely; instead, they have a video streaming feature at best. Our proposed sys- tem can not only stream the video of the baby 24/7 but also uniquely identify multiple babies, which makes our proposed system a perfect option for parents with multiple kids. Also, most moni- toring systems consist of a camera and a receiv- ing device. Without the receiving device, it is impos- sible to keep track of the baby. Our proposed system covers this exciting feature by converting our mo- bile phone into a receiving device so parents can check on their little ones with just a few clicks and swipes as we carry our mobile phone everywhere with us..

IV. SYSTEM ARCHITECHTURE

Block diagram with its peripheral inter- faces of the proposed system is shown in Figure 1.

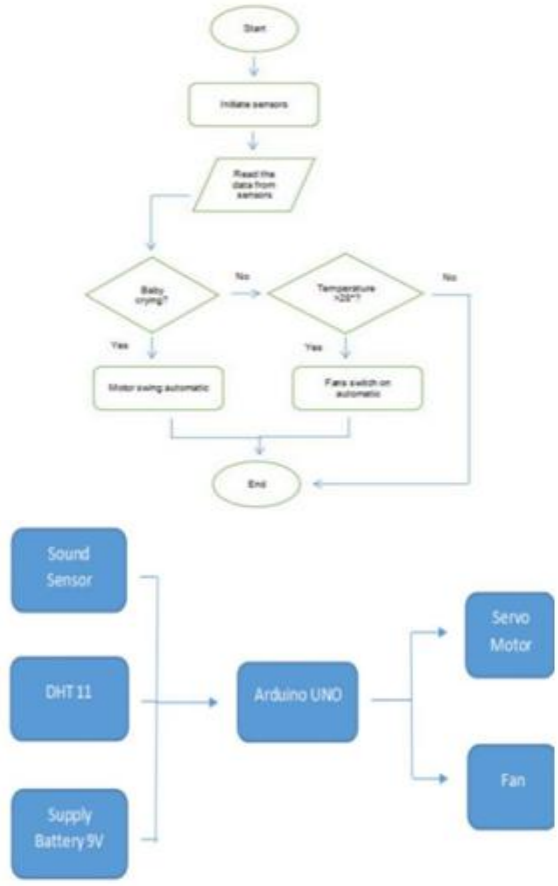

Figure 1. Block diagram of the proposed system

V. MODULES

This entire can be divided into four modules namely,

1. **Software Tools**
2. **Hardware Tools**

SOFTWARE TOOLS/ALGORITHMs:

OpenCV Python Library: In this paper, CV2 and Face recognition, these two OpenCV Python librar- ies have been installed for the face-recognition pur- pose. Also, the NumPy Python library has been in- stalled for accessing multiple data and handling im- age data by converting them into matrices. This operation helps us to compare images from the live feed and source folder

HARDWARE TOOLS/ALGORITHM:

Moisture Sensor: A moisture sensor is a module that is used to check whether the diaper or mattress of the baby is wet or not. In this work, we have used a soil moisture sensor for this purpose.

- Ultrasonic Sensor: An ultrasonic sensor is a mod- ule that measures the distance of a specific object by emitting ultrasonic waves. We have used the ultrasonic HC-SR04 sensor in this paper to detect the child's presence in the cradle.
- Sound Sensor: A sound sensor is a module that de- tects the intensity of the sound and converting it to electrical signals. We have used the LM393 sound sensor to recognize the baby's crying.
- Servo Motor: A servo motor is a module that can rotate an object with great accuracy. We have used the mini servo motor SG90 to swing the cradle when the proposed system detects the crying of the baby.
- Temperature-humidity Sensor: A Temperature- humidity sensor is a module that measures the sur- rounding air and gives a digital signal. We have used a DHT22 temperature-humidity sensor to measure the temperature of the surroundings of the child.
- GSM Module: A GSM module is a device or a chip that is used to establish communication between a smartphone and a machine. We have used a SIM800L GSM module to initiate a voice call and send text messages to the parent's phone.
- DC-to-DC Buck Converter: A DC-to-DC con- verter helps the voltage to step down so that the sen- sors which work in low voltages are not burnt. We have used an LM2596 DC-DC buck converter step-down power module, which provides output voltages of 1.25V–35V.
- LCD Display: An LCD is an electronic display that uses liquid crystal to produce a visible image. We have used an LCD 16×2 display.
- Relay Module: The relay module is a device used for remote device switching. We have used a Songle single-channel relay module.

VI. WORKING

After the entire system has been successfully con- nected and turned on, the various sensors will con- stantly capture data to detect any anomaly. The message on the LCD screen, "Monitoring Baby," confirms to the user that the system is running correctly. The sensors used in the system start to send the signal to the Arduino Mega microcontroller to call the parents or alert them via text message. The mic sensor constantly picks up noise from the baby crib. It has been coded to send the signal to the Arduino when it picks up a sound ranging from 110–135 decibels. Thus, whenever a crying sound is detected, the mic sensor alerts the Arduino, and the Arduino plays a lullaby to calm the baby and sends a text message to the parent's cellular device to alert them of the current situation. The moisture sensor is used to detect if the diaper of the baby is wet or fresh. The sensor shorts itself and passes a small electric current within itself when it comes into contact with water. When the short-cir- cuit occurs, the microcontroller gets the signal that the baby's diaper is wet and immediately initiates a phone call alert to the parent's mobile phone. The ultrasonic sensor is utilized within the system for the sole purpose of detecting whether the baby is in the cradle or not. The ultrasonic sensor constantly sends out ultrasonic sound waves. So, when the baby is not present on the crib, the Arduino gets a signal from the ultrasonic sensor and initiates a phone call to the parent's phone. For this sensor, the baby is considered as an obstacle, and when the ob- stacle is removed, the sensor sends a signal to the Ar- duino

VII. SYSTEM METHODOLOGY

- Swinging cradle
  This system uses a cry analysis system that automatically swings the cradle when it de- tects a baby crying.

- Infant care
  This system uses sensors to measure a ba- by's temperature, voice, and moisture con- tent. The system displays messages and vi- brates to alert the user.

- Wireless sensor network
  This system uses sensors to detect the ba- by's temperature, humidity, crying, and body movement. The system can send an SMS to a registered number if one of the sensors is activated. The user can also send a request SMS to receive data from all of the sensors.

- IoT and Arduino
  This system uses sensors to detect the ba- by's temperature, humidity, crying, and wetness. The system also uses a camera to provide live video footage.

- Pulse and humidity sensor
  This system uses sensors to measure a ba- by's heart pulse and the humidity inside an incubator. The data is sent to a computer via Arduino.

- Child monitoring
  This system uses sensors to provide infor- mation about a baby's health. The Arduino microcontroller processes the data and sends it to a computer.
- Wireless health monitoring
  This system uses sensors to measure a pa- tient's heart rate, body temperature, and the level of saline liquid. The system alerts doctors and caretakers if any of the parame- ters are outside of a threshold value..

Specification of each component identified in the prototype is give in Table 1.

Table 1. Specification of each component

Comp No.	Name of the components	Specifications
1.	Sound sensor	KY037
2.	DHT11 sensor	DHT11
3	Servo motor	SG90 micro
4	DC Motor	25 Watts
5	AC Motor fan	
6	Regulator Power Supply	

VIII. RESULT AND CONCLUSION

A smart baby cradle system is intended to solve the problem that parents, babysitters, and anybody else with a baby face when caring for their child. This project made it easier for individuals to look after their children, especially for working parents, or even while they sleep at night. It is no longer necessary for parents to go to their children to swing the cradle. The project reduces human effort and the stress of parents during working hours. A motor, sensors, and an oscillating carriage are the components needed for a baby care equipment. The overall mechanism is movable, allowing for easy transfer between rooms too. The benefit of this system is that it has a low initial cost and allows for minimal operational costs. The technology has a lot of room for improve- ment and operational efficiency, to be commercially viable and appealing.

IX. FUTURE SCOPE

A smart baby cradle system is intended to solve the problem that parents, babysitters, and anybody else with a baby face when caring for their child. This project made it easier for individuals to look after their children, especially for working parents, or even while they sleep at night. It is no longer necessary for parents to go to their children to swing the cradle.

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In future with the efficiency of artificial intelligence people would improvise the system with feeding, medical care, oxygen support and many more specifications will be added

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