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Smart Infant Cradle in Clinical Perspective using H-IoT with Android Application

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Abstract: *In scheduled time monitoring the infants in a hospital or at home where the monitoring with human resources, especially nurses is exceptionally difficult. So, these infants can be monitored 24*7 using a device. Infant health monitoring became a fast-growing technology in the medical field. Hence, we are implementing an H-IoT where health monitoring sensors are used. A smart cradle, put into practice which utilizes the basic data from the infant-like heartbeat pulses, temperature, bed wetness, cry pattern, and movement. These parameters-related sensors are associated with the Arduino UNO to keep track of these, the various parameters are displayed in the dashboard. If the system notifies any unforeseen changes in the infant, then it will spontaneously caution the infant status in call notification using the Global System of Mobile Communication module. In this manner, IoT health monitoring is fetched for the monitoring of infants in a real-time environment.*

Keywords: H-IoT, Smart Cradle, Baby Monitoring, Clinical Perspective

I. INTRODUCTION

In India in recent years, both parents working has been common. In these times baby monitoring will be the most demanding thing. The most communal problem that premature babies face is PDA and low blood pressure (hypotension), and trouble breathing due to an immature respiratory system. They also lose their body temperature and suffer due to an underdeveloped immune system etc., On a survey basis, 4 million babies worldwide would die in the first month of their life due to low birth weight. The elevated temperatures and humid environments also make babies suffocate. These types of conditions create additional threats to the baby's health. To support the baby's condition, they require an additional controller in an incubator for maintaining the baby's body temperature, humidity, pulse rate, and oxygen flows without any assistance. In the same way, when the premature baby's period in hospital is completed, they need to be taken utmost care of in their homes too. Caretakers and parents alone cannot take care of a baby minute to minute. In general, in hospitals, the incubator protects and watches the baby's condition with every parameter that needs to be monitored.

II. LITERATURE SURVEY

In today's world, technologies are used in all places. "Smart Infant Cradle" this existing system had its growth from past 2018; they implemented minimal infrastructure to the cradle using, Bluetooth, only IoT, or using the GSM alone. The prototype was also evaluated with the time delay of the upload of data from the system to the MQTT server. The process of uploading and fetching the data to and from the server had a time delay of approximately a few seconds. Several testing processes were performed, and no time delay was seen in some instances. However, some results of the testing showed a slight time delay.

2.1 Methodology

1. Using Microcontroller ATMega328p.
2. Connectivity using GSM module SIM800C.
3. Using sensors like humidity sensor, pulse sensor, accelerometer sensor, and Sound sensor.
4. Wi-Fi Connectivity - IoT Gateway.
5. Login credential security using firebase servers and encrypting the application details.

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2.2 Proposed System

The proposed system is to monitor the infant and show the values to the doctor and the guardians can view the growth of the child using an android application and data will be collected in the web dashboard. The system connects with the sensors and using the Wi-Fi makes the transmission of data in a swift way. Also, this can be implemented in hospitals for the doctors' care and the usage of call notification helps the mother to reach the child from a long distance too. The Temperature emitted from the devices is reduced and the swing of the cradle is done when the sound level goes higher than 27dB and increases step by step when the level increases. The accelerometer sensor attached to the cradle helps to check out the axis of the child and to figure out the presence or absence of the child in the cradle.

2.3 Scope of the Project

The project focuses on the implementation of the Health Care sensors with the Internet of Things in the monitoring of infants 24 X 7. The research extends with the free monitoring of the heartbeat, humidity, and bed wetness. By the data we have the details will be shifted to a cloud server and traced back to the mobile application.

2.4 Block Diagram Description

The block diagram starts with the infant, when a child is sleeping in the cradle the sensors like noise, humidity, and heartbeat sensors. The Analog signals are captured by the sensors which have sensory nodes. The Analog sensors like pulse sensor, sound detection sensor, and bed wetness detection sensors are connected to the microcontroller where the servo motor will be connected, and which will be displayed on the LCD. The Microprocessor (Node MCU) gathers the Analog sensors and converts their digital values and stores them up in cloud server memory.

The cloud values are displayed in the dashboard and the mobile application. When the sensor detects the cry it sends the notification to the parents and the guardian person near the infants. The stored data transmitted to the cloud gateway via the Node MCU connects with the web dashboard that can be viewed by the doctors. Next, when the child's threshold value shows as high then the call notification will be sent to the mother's phone by using the GSM.

Threshold levels:

1. Heartbeat sensor (for pulse): if above 65&&74bpm
2. Sound sensor (for cry): above 28dB
3. Humidity sensor (for wetness): above 1500RH

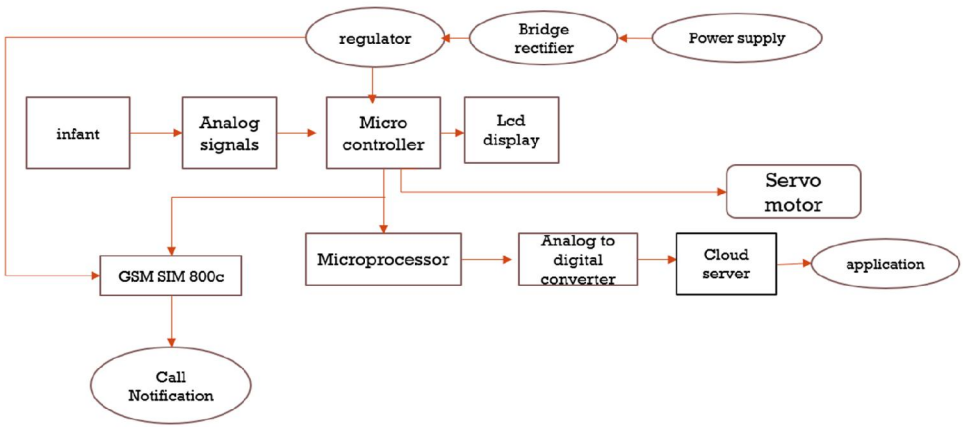

Figure 1: Proposed block diagram

2.5 Circuit Diagram Description

The sensors used in the proposed system are humidity sensor DHT11 with the 20 to 80% humidity detection range, heartbeat sensor with the measuring range of threshold 550: accelerometer sensor 3 axis. The out-data pin of the DHT11 humidity sensor is connected to the analog A0 of the Arduino UNO microcontroller. The Tx pin of the Arduino is connected to Gsm with RX pin the out-signal pin of the humidity sensor is connected to the analog pin A1, in the A2 pin heartbeat

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sensor, in the A3 pin sound sensor, A4 pin accelerometer sensor of the Arduino UNO microcontroller. The Wi-Fi module ESP8266 (Node MCU) is programmed as it can connect with the wi-fi network to transfer data to the flutter application developed using Android Studio. Cradle relates to a servo motor is driven by the Arduino UNO Microcontroller through the digital Pin No.5. The digital Pins of Arduino UNO relate to LCD from 7 to 8. Pin 9,10,11,12 relates to GPIO 0-3 of Node MCU.

III. System Design Flow

The program flows by getting the input parameters like sound, humidity, and the heartbeat variables. According to the threshold levels set to the sensors, if the threshold level is reached the cradle starts to swing at first and when the sound sensor value is more than 30dB then the sensor makes an alert to the GSM network hence a call will be notified via mobile phone only when the child started to cry. Then the flow goes with the humidity sensor too only if the humidity value increases the call notification will be done. In the mobile application, the things will be displayed as push buttons if an unforeseen change occurs in the heartbeat the color of the icon changes. These changes are periodically sensed and recorded in the server.

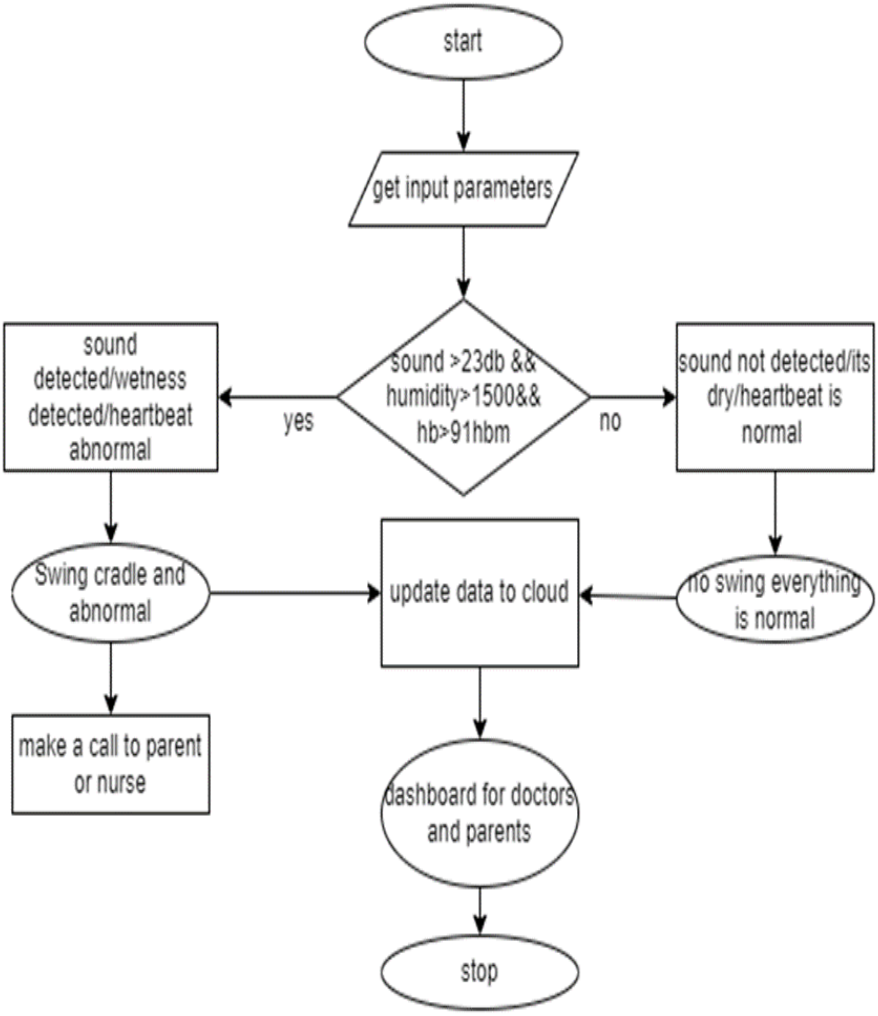

Figure 2: Flowchart Diagram

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IV. OUTCOMES

4.1 Hardware Implementation

The desired output that is obtained by the Hardware implementation is shown below:

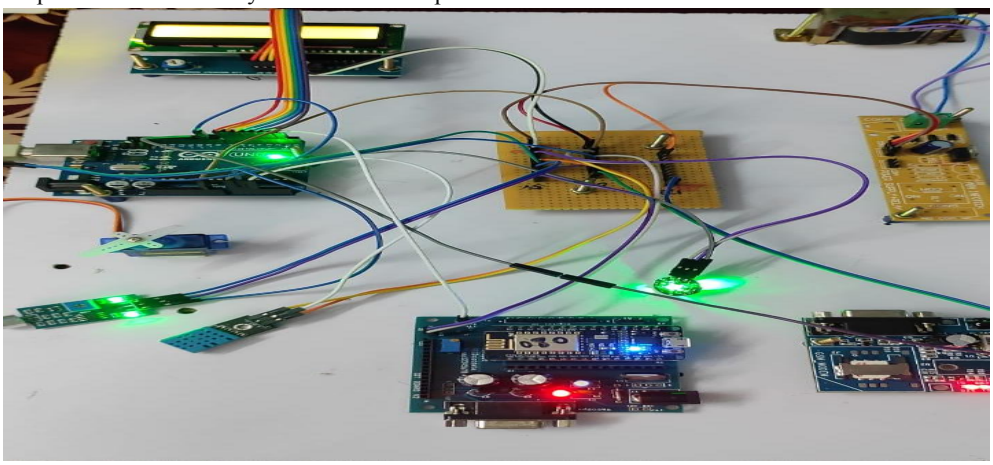

Figure 3: Hardware Connections

4.2 Software Implementations

The desired output that is obtained by the Software implementation is shown below:

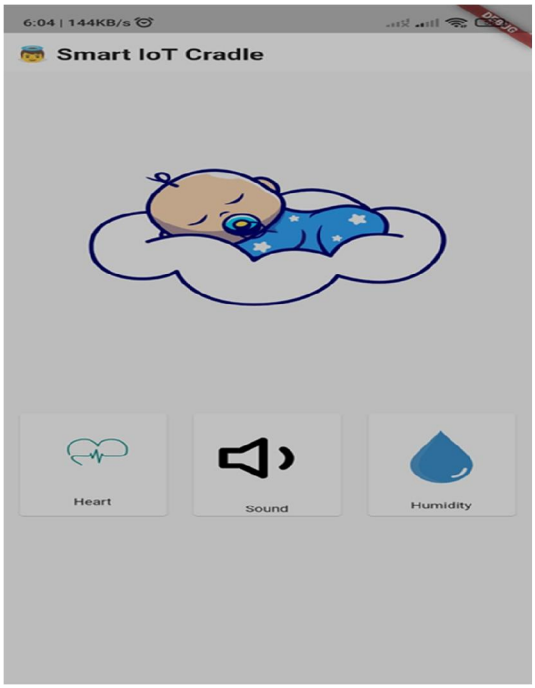

Fig. 4: Application output

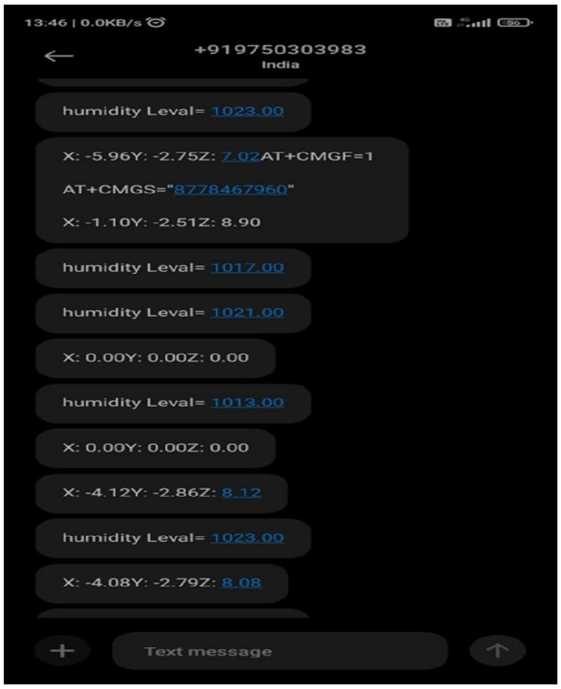

Fig. 5: GSM SMS output

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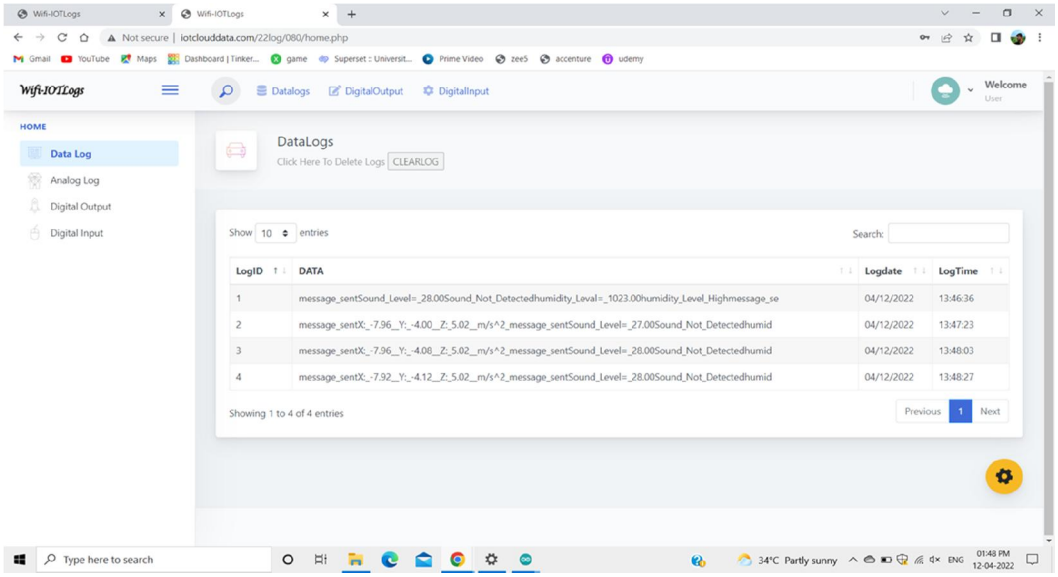

Figure 6: Dashboard output for doctors

V. RESULTS

The existing problems seen within the traditional cradle system are often overcome by introducing technical & electronic approaches within the system. With this model, the doctor can monitor and control their patient or infants from anywhere. The real-time values are going to be shared with guardians using message services. This will also increase their security and there would be a change in the baby monitoring system. The smart cradle isn't that difficult to try to implement in a traditional cradle. For this project, the setup of the cradle is done primarily on a small scale. Using the application of the Internet of Things in the system, it has been possible to view the readings from anywhere in the world, and it provides a graphical and analytical view of the parameters in this system. It's part of the project is the development of relative and routine information that is all the available through cloud storage as data content, it further makes it easy to utilize and get to know the future improvement in the technological domain. As per the objective specified, H-IoT Based Smart Cradle was developed with the use of Arduino Uno and ESP8266 as the main controller and the Internet of Things as the exclusive feature in the system. This system can monitor the values of system parameters like Heartbeat value, and wetness, acceleration movement of the baby with the sound sensor detector on a real-time basis.

VI. CONCLUSION

Emerging technology in modern world makes people to run in their way to reach their zenith. That's the same thing happens in the Smart Cradle. At first cradles were made in the developed companies when they got to be installed in developing companies there were many different modes to assist them at home particularly. The clinical perspective of the smart cradle makes them to implement in the hospitals where the doctors can get details of the newborn infant UpToDate from their seats. The android application developed using Flutter became an easy on to switch them between the servers and the IoT Gateway the transmission time of the data was quite 0.45s than normal dashboard given by Things Speak, Arduino Cloud or IoT data base. The measurement of the heartbeat, Temperature and the movement of the baby noticed with the accelerometer where near to approximate values. This Project Can be developed with the Raspberry Pi and implementing the Machine Learning techniques to identify the image of the child. By which this can be implemented for large scale like the Hospitals.

VII. ACKNOWLEDGEMENT

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BIOGRAPHY

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