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Baby Monitoring System for Smart Cradle Using Internet of Things

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Abstract: Smart Cradle System using IOT which help's the parents to monitor their child even if they are far away from home. They can also detect every activity of the baby from any corner of the world. Nowadays the number of working mothers has greatly increased. Therefore, baby care has become a daily challenge for many families. Parents cannot monitor their baby continuously therefore most of the parents send their baby to their relatives or baby care houses. The design of Smart Cradle supports video monitoring. Cradle swings on detection of baby cry sound. This system considers all the details which are required for the care of the baby.

Keywords: Internet of things (IoT), Smart Cradle, Baby Monitoring, Cry Detection, Sound & Humidity sensor.

I. INTRODUCTION

As we are familiar with the hurdles faced by parents to nurture their infant and especially in case if both the parents are working. They cannot keep an eye on their child all the time and working parents cannot always care for their babies. They either send their babies to their parents or hire baby care while they are working. Some parents worry about the safety of their babies in the care of others. Even so, various products support baby monitoring, many of them are not efficient enough.

Therefore, we should develop something unique with high-quality features that can help parents. One of the most substantial roles for IoT is the real-time monitoring of babies. So, the objective of this work is to create a baby monitoring system for a smart cradle based on IoT devices, which is AVR Microcontroller ATMEGA8. This system monitors the baby using the camera, microphone, speaker, and sensors for measuring temperature and humidity. This cradle system consists of the following functions: 1. The automatic swinging of the cradle starts on the detection of the baby cry sound. 2. Sounds an alarm and sends an alert on the Smartphone when the baby does not stop crying after a specific time. 3. Sounds an alarm and sends an alert if the mattress is wet.

II. LITERATURE REVIEW

Y. Lu and J. Cecil [1] presented an IOT based collaborative framework for advanced manufacturing. This system detects an IOT-based framework of next-generation networking technologies to support interaction between cyber and physical resources for electronics manufacturing specially PCB assembly.

M. Levy et al [2] proposed a smart cradle for babies using the FN-M16P Module. This system explains the infant monitoring system with real-time Alerts to parents using GSM. Activity monitoring includes infant's cry detection which makes the cradle swing with pre-recorded voice play and alerts to parents for their intimation.

K. Lohekar et al [3] designed Smart Baby Cradle. In this system, the design and implementation of a new indigenous low-cost smart baby cradle were implemented, which soothes the baby with some soft music when the baby cries. It cries analyzing system which detects the baby's cry and accordingly the cradle plays some soft music for the baby to stop crying.

Yogita K. Dubey et al [4] presented the baby monitoring system using an image processing system and IoT. The system using image processing is proposed in this paper which is used for proper safety and monitoring the activities of the baby. This system will help in decreasing the chances of the babies falling from the bed.

Nazia Hassan et al [5] intended the Design and Development of a Smart Baby Monitoring System based on Raspberry Pi and Pi Camera. This system can detect the motion and crying condition of the baby automatically. The Raspberry Pi B+ module is used to make the total control system of the hardware.

A. R. Telepatil et al [6] presented Intelligent Baby Monitoring System. This system was implemented to detect babies crying sounds, motion as well as live streaming of baby position in the cradle. To design and develop the baby cradle using Raspberry Pi B+ as a control unit.

Dina M. Ibrahim et al [7] proposed Raspberry Pi- Based Smart Infant Monitoring System. The idea is to design a system that will simplify the process of monitoring the baby by using the Raspberry Pi device. The proposed system

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has the features like displaying live video and audio.

III. PROPOSED WORK

The proposed system is used to monitor the activities of the baby remotely. Fig.1 shows the various hardware components used in this system. The sound sensor is used for cry detection, and to get the wet condition of the baby humidity sensor is used. The temperature sensor is used to know the babies' body temperature. If the baby is making a noise or the baby is crying then the sound sensor will hear that frequency and it will notify the parent through a pop-up notification. Also, the buzzer will turn on. If the baby had wetted the matrices of the cradle, then an alert notification will send to the parent through the notification module. If the body temperature of the baby changes rapidly with comparing atmosphere, then an alert will send to the parents, and a buzzer alarm is turned on so that parents will come to know that something is wrong even if they are unable to get a notification through mobile phone.

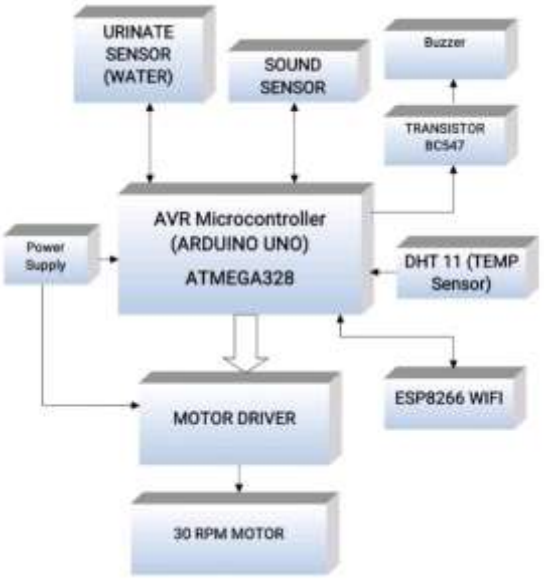

Fig.1 System Block Diagram

Fig.2 represents the architecture of the baby monitoring system. Initially, the user has to register for the app to use the system. Then after the user will get the benefit of this system. When the baby cries notification is sent to the parents then they swing the cradle with the required speed. If a baby gets urinated then the message is sent to the parents regarding the wet condition of the baby. If the babies' body temperature is above the normal temperature, then the notification will be sent to the parents. Video monitoring is used to record all the activities of the baby.

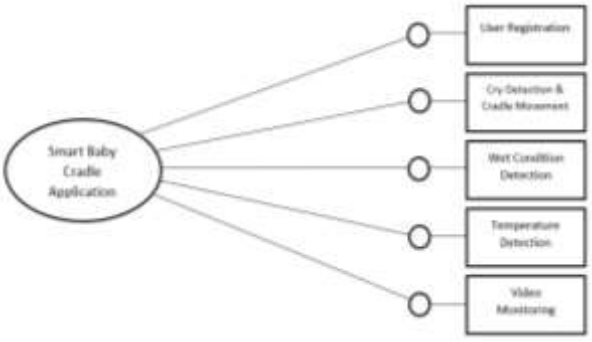

Fig.2 Architecture diagram of smart baby cradle system

IV. Design of Smart Cradle

Every product needs a complete design with exact measurements before it can be fabricated. The design plays a fundamental role in this system. Therefore, before the design process, a few things were considered. The design of the baby cradle shown in Fig.3 is designed by using NX10. For this baby cradle, we assemble the main components, which allow swinging and attachment of the developed monitoring system.

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Fig.3 Design of cradle.

V. Implementation

The modular design shows the connection and the testing of the outcome of the system for better optimization. The fan is set to turn on automatically whenever the measured temperature reached 28 °C or higher. The sound sensor is given a certain range of threshold values because the value measured by the sound sensor had a slight fluctuation. Whenever the measured value exceeded the threshold value, the DC motor connected to the relay was turned on to swing the baby cradle.

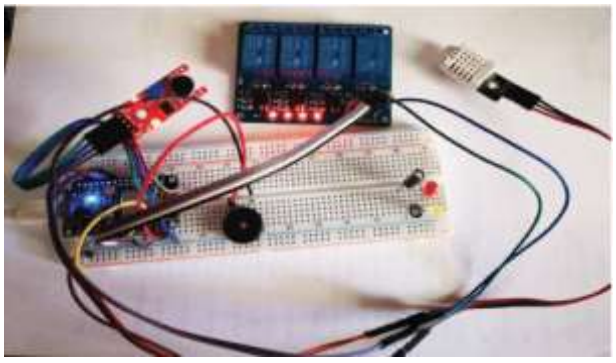

Fig.4 Hardware Arrangement

After enhancement and optimization, some components were soldered on the Donut board. A pair of female headers were soldered on the donut board for the microcontroller, which can be removed whenever any replacement is required in the future. The sound sensor and the temperature and humidity sensor were placed outside the solder board to measure the surrounding readings. Each microcontroller pin was extended using the female headers. Each microcontroller's female header pin was soldered to each extended female pin on the donut board and tested with the digital multimeter to ensure the continuity and sufficiency of each pin. Figure 12 shows the pin solder connection on the top and bottom views.

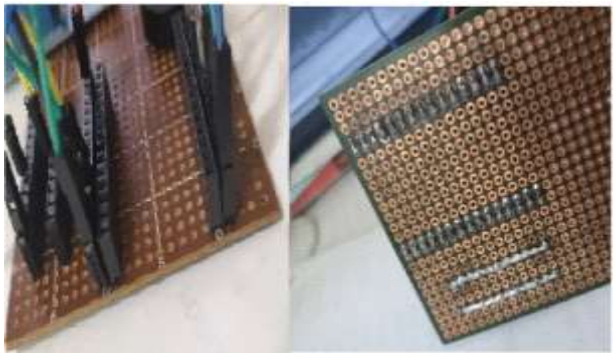

Fig.5 Hardware Pins

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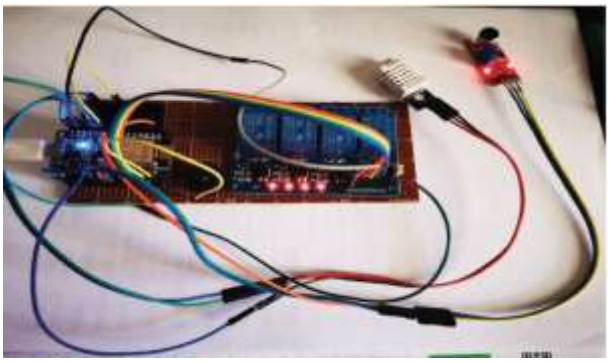

Fig.6 Hardware Connection

VI. RESULT & FUTURE SCOPE

In this section, the results, discussion, and validation of IoT-BBMS are presented in detail. It shows the final prototype of the developed smart cradle. Several manufacturing steps were carried out before the implementation of the control system for the smart cradle. This IOT Based Baby Monitoring System can be enhanced with features analyzing the behavior of babies such as, after what interval the baby is hungry, also the sleep routine of the baby. Furthermore, the addition that can be done to advance this system is the swing can be automatically swinging after cry detection through sensors.

Fig.7 Cradle Design

Fig.8 Application Layout View

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Fig.9 Cradle Connection View

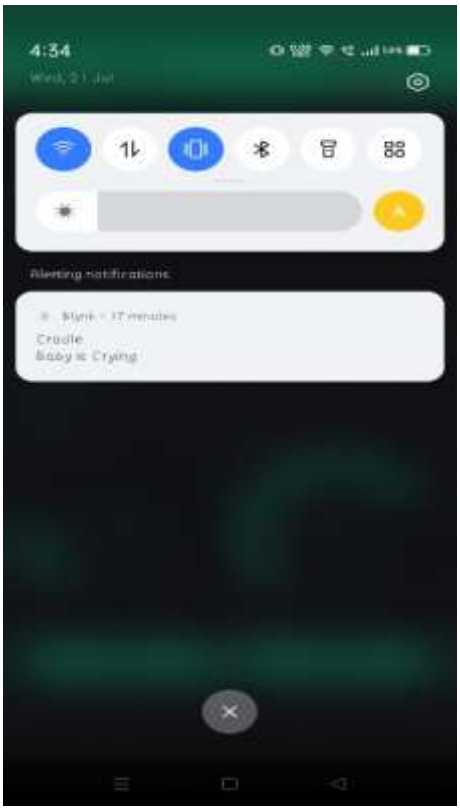

Fig.10 Receiving Notification

VII. CONCLUSION

Our proposed system aims at monitoring the vital signs of the baby such as humidity and temperature using sensors. Baby care is a hard problem worldwide. It is very important for our future, considering the need of the present world and knowing the significance of baby care, this system is designed. This system is economical and easy to operate which helps working parents to manage their work. Video monitoring is made available through the most commonly used android smartphones. This system can provide both audio and video output at the same time. It can be applied to the home environment as well as in the hospital or baby nursing care. Effective use of this system can remove the anxiety and monotony of the parents. The safety issue of the baby is also confirmed in this system. Although this system is implemented, further improvement and modification of the system can be done.

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