An Innovative Approach for Infant Monitoring System using Pulse Rate and Oxygen Level

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ABSTRACT
Monitoring health parameters of newborns such as respiration patterns, oxygen level, sleep activity etc. is necessary to ensure salubriousness of their health. A conventional approach does not efficiently provide the real-time updates of these baby health parameters. Also, this approach avails parents to constantly monitor the parameters of a baby to ensure their health. As both parents nowadays, work outside and it is not always possible to monitor the baby in-person, it is necessary to make use of modern technologies. It will be beneficial for the parents to readily track the health of the infant and getting updates in detrimental conditions. Also, the parents could be equipped with the suggestions about preventive measures which should be taken at the given time. To detect any unfavorable condition of the baby, the monitoring parameters are compared with the normal or under control parameters. Whenever parameter rises above the threshold, parents are informed.

Keywords
Android Mobile, Arduino board, Bluetooth, Cloud, Microprocessor, Short Messaging Service, Global System for Mobile, Sudden Infant Death Syndrome.

1. INTRODUCTION
In India, both the parents need to work and look after their infant, so more workload and stress is there in such families, especially on female counterparts. Increasing female participation in various work fields have given rise to a need where

Women have to take care of their family and at the same time handle the work pressure. Subsequently, infant care has become a challenge to many families in their daily life. Mother always worries about the well being of her baby while working. In order to tackle this, a 'Baby Monitoring System' can be developed which would help the parents to track the infant's health and also obtain continuous updates of health.

Besides this, the system will also notify the parents about the abnormal situation so that they can take appropriate steps accordingly. The system will help the parents to take care of their child not only when they are at home but also when they are at the office or outside their home. A conventional approach to monitor the infant includes constant monitoring of infant using a web camera or keeping nurse for the baby or using audio monitoring. But, this system will provide peace of mind to parents when they are away from their infant as they

can obtain the updates of health of baby. Communication is done by GSM interface in which Short Messaging Service (SMS) is a fundamental part.

Earlier the manual participation was required for monitoring babies which was a tedious job. With the advancement in technology, various different types of baby monitoring systems were introduced such as Sound Monitors which included the use of transmitter and receiver to transmit the voice of baby to its parents. The main drawback of this system was that the device was capable of transmitting the voice only in one direction that is from baby to its parents but not vice versa.Another system that used Video Monitors displayed the video of baby's live activities continuously to parents. The problem with the above systems was that they were inefficient to take appropriate care of the baby as they either used video or audio which was inefficient to provide the proper information and parameters of baby's health. This proposed system focus on the information that it receives from sensors which would be helpful to maintain health of a baby by transmitting audio and video data. Additionally, text messages are sent to parents in order to provide the live updates of baby's health and thus overcome the drawbacks of the above-mentioned systems.

2. REVIEW OF RELATED WORK
Andre G. Ferreira et al. A Smart Wearable System for Sudden Infant Death Syndrome Monitoring, SIDS i.e. Sudden Infant Death Syndrome is one of the major causes of death among infants during sleep. The wearable IoT device is a wireless sensor node integrated into a chest belt, and it monitors parameters such as body temperature, heart and breathing rates and body position. If a critical event occurs, the device will trigger an alarm, visible and audible in the proximity and sends a distress message to a mobile application. [1]

Mairo Leier et al. Miniaturized Wireless Monitor for Long-term Monitoring of Newborns, Wireless infant monitoring system is a small size wearable sensor platform. In this paper; they proposed a monitoring system that detects the most important vital signals of baby and transmits results over a wireless link to the control device that could be any Smartphone. By measuring the raw signals, it is possible to use this system in different, possible life threatening situations during long-term monitoring. [2]

Angelo M. Fonseca et al. A Sudden Infant Death Prevention System for Babies, the Sudden Infant Death Syndrome (SIDS) is an expert diagnosis when an apparently healthy baby dies

due to some imperceptible cause. This paper proposes a mobile solution based on biofeedback monitoring that tries to prevent the sudden death of infants. When an issue is detected by this system, it sends a warning to parents. Mobile devices are used to process the sensed data and monitoring baby and performing alerts/ warnings when an abnormal situation is detected. [3]

Savita P. Patil et al. Intelligent Baby Monitoring System, this system monitors vital parameters such as body temperature, pulse rate, moisture condition and movement of an infant. By using GSM network, this information is transferred to their parents. Measurements of these vital parameters can be done and under risk situations, this information is conveyed to the parents with alarm triggering system to initiate the proper control actions. The system architecture consists of sensors for monitoring vital parameters, LCD screen, GSM interface and a sound buzzer which are controlled by a single microcontroller core. [4]

Octavian Dospinescu et al. Implementing Monitoring Systems in Mobile Applications a Case Study, this case study is presented for a monitoring system using the Android platform and the benefits of computer Networks. The power of mobile sockets and mobile threads is integrated into a complex architecture in order to obtain a real monitoring system. As an immediate application, a baby monitoring system is proposed where children could be remotely supervised by their parents. The case study is based on Android mobile client-server architecture and also uses the capabilities offered by the phones speaker and microphone. [5]

V.Ramya et al. Embedded Patient Monitoring System, the condition of patient in ICU can be informed to the doctor through wireless. In medical professionals, it is necessary to continuously monitor the condition of patient to track their health and understand various parameters. A device is introduced which can monitor continually and do the data logging without any interruptions. Moreover, in the critical condition, an alarm could be raised and concerned doctor is notified using SMS. [6]

G. Rajesh et al. Baby Monitoring System Using Wireless Sensor Networks, sudden death of an infant during sleep which remains unexplained even after death investigation is marked by SIDS. This system provides solutions by making a smart crib using WSN i.e. Wireless Sensor Networks and Smart phones. The service of visual monitoring is also be provided through live video. The alert services can be provided by making use of fencing of the crib. Also, monitoring services can be delivered by temperature reading, vaccine reminder and weight monitoring etc. [7]

Yedu Manmadhan et al. Remote Patient Monitoring System, this paper provides an image-based techniques to acquire and analyze a constant streaming of ECG signal through the digital camera for image capturing, information extraction and analysis performed using MATLAB tools as well as data sending system based on Internet network. This method captures the vital signs and parameters from the ICU monitoring machine using web camera and transmits the image through the Internet. This original image is then availed to the consulting doctor via an ANDROID cell phone. In case of an anomaly, a notification is sent to the doctor's phone. The paper proposes a method to capture, compare and generate an alert regarding the patient's condition using the heart rate and make the captured image be available to the physician. [8]

Suresh B et al. Advanced Baby Care System, constant

monitoring of the child is necessary especially up to an age of 18 months. In this, a mobile robotic device has been designed and developed which can help a parent to track their baby and its surroundings without having to check on the baby every now and then. Advanced Baby Care System (ABCS) has a Master Controller (Arduino Mega 2560), which integrates all the different modules of the robot by receiving the necessary signals from the sensor modules and sending signals to the trigger alarm and the DC motors. It is a microcontroller board based on the ATmega328. This board can be easily interfaced with the CMUCam5 module, used for tracking, as well as other sensors which are being used in the project. ABCS is an intelligent, baby friendly system, which integrates many functions into a single device, automatically alerting the parent when it is necessary and allowing them to carry on with their activities uninterrupted. [9]

Chanakya Mothukuri et al. Patient Monitoring System, in present days, real-time monitoring of the physical condition of the patients is one of the major challenges faced by hospital authorities. Here, a Patient monitoring system is implemented which will be one of the major improvements in the hospitals. All the hospitals today have the monitoring systems which are wired. Also, human intervention is needed frequently for critical patients. In this proposed system i.e. PMS (Patient Monitoring System) is operated wirelessly. This wireless patient monitoring system in this paper measures heartbeat, body temperature and percentage of oxygen in the blood. This paper discusses the design and development of a low-cost apparatus which uses GSM technology for monitoring the health condition of the patient. [10]

3. PROPOSED METHODOLOGY

In this paper, the proposed methodology, tries to overcome the limitations of the earlier system. It mainly consists of sensors, hardware unit, cloud server and parent's application. The following diagram shows how these all element interact with each other.
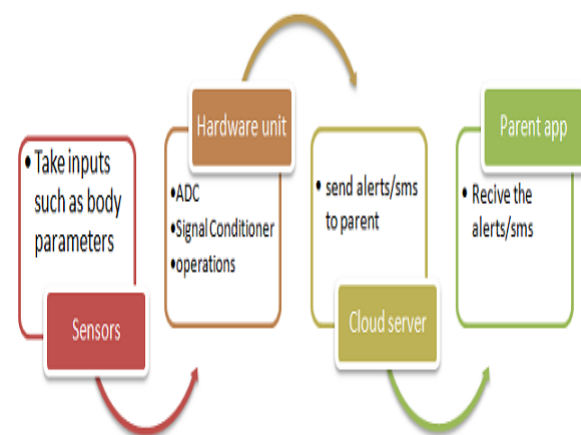

Figure 1. Proposed methodology

The system will take two inputs from the sensors which are pulse rate and oxygen level. Signal conditioner will be used for signal conditioning that will maintain originality of signal required for next stage of processing thus by eliminating noise for proper data acquisition.

An ADC is an electronic device that converts an input analog voltage or current to a digital value proportional to the magnitude of the voltage or current. The microcontroller chip

in the system consists of Bluetooth controller which is a wireless technology standard for exchanging data over short distances. Using this Bluetooth controller, the input data of the sensors can be easily transferred to the hardware unit.

The hardware unit will perform various tasks. It will compare the input parameters with the threshold values and immediately forward the data in case of anomaly. Hardware unit will also forward the data to the cloud server through the Internet which then forwards the parameters to the parent's phone. So, this hardware unit will be connected to the microcontroller using Bluetooth and will also be connected to Cloud Server through the Internet. Hardware unit must be constantly connected to the Internet in order to forward the data in real time and efficiently.

Cloud server will then forward this data to the parent's phone by making use of Internet. The real time measurements of the sensors can be forwarded. The android app will notify parents about the child's health parameters. The alert system will be activated and will start alarming if there are troublesome readings. It will help parents to understand the situation and take immediate actions on the same. SMS will be sent to the parent's phone in order to notify them about the situation.
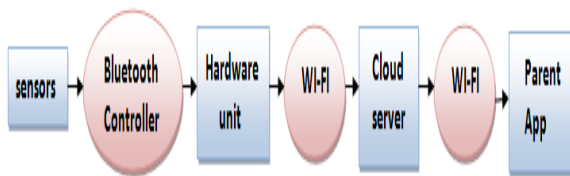

Figure 2.System flow

The overall flow for the system is shown in Figure 2 which is the flow graph for the proposed methodology. The user would place the sensors at infant's feet which measures the health parameter and sends it to hardware unit which performs various operations and sends the result to a cloud server and further forwards notifications to parent's application.

4. SYSTEM ARCHITECTURE

Figure.3 shows the architecture of the system. The architecture consists of sensor based environment for measuring the health parameters of an infant.

The architecture explains the usage of the android based application to compare the values obtained by sensors with the threshold value and sends the result to the cloud server.
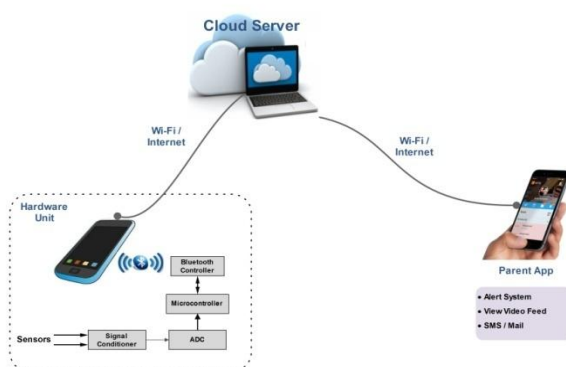

Figure 3.System Architecture

5. CONCLUSION

Existing systems does not provide real-time updates on parent's phone, rather it simply generates an alarm. Not many monitoring systems are available that can be used with ease at home. It is also necessary for parents to keep track of baby when they are not at home. Hence, in this proposed system, the limitation of earlier system has been overcome by providing the continuous monitoring of infant's health. This data can be used not only to track infant's health at home but also useful to continuously monitor babies at hospitals especially where manual monitoring is not always possible. In future, the size of the monitoring device can be reduced. Also, the accuracy of the sensors can be refined in order to get precise measurements.

6. ACKNOWLEDGMENT

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