



DEVELOPMENT OF IOT BASED INTELLIGENT MONITORING SYSTEM FOR NICU

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Abstract : - The healthcare monitoring is one of the important domain in medical field which involves continuous monitoring of health parameters from the patients. Neonatal Intensive Care Unit (NICU) is a dedicated area which is used to take care of sick and premature neonates. Baby neonatal Incubator is a closed apparatus used for providing a controlled environment in all the possible ways for the immense care of premature babies. There are various health parameters such as oxygen level, temperature, pulse level, respiration pattern which need to be monitored in order to ensure good health of the neonates. Conventional approaches of baby monitoring in incubators does not efficiently provide real-time parameter updates and requires constant monitoring of baby through the presence of nurses or doctors. Hence, modern technologies must be used in order to track health of infant in the incubator and get updates in any unfavorable condition. The proposed method uses Internet of Things for continuous monitoring of the parameters such as temperature, humidity, Pulse rate of the neonate, gas leakage and light intensity in the incubator. If these parameters exceed from the threshold level, an alert message will be sent to the doctor or to the desired medical person via e-mail or SMS. This system is capable of updating the parameters continuously in the cloud and also avoids continuous monitoring of the neonates by the person.

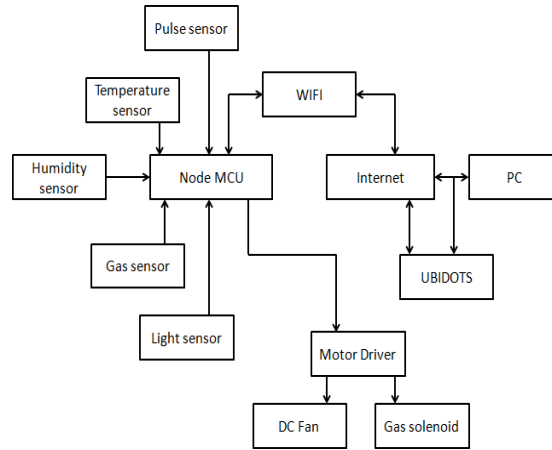
IndexTerms -. Healthcare monitor; NICU; neonates; parameters; Temperature; Pulse; Light level, MEMS

I. INTRODUCTION

The current technological development is a boon for various healthcare services in day to day life, which helps in remote monitoring of health parameters from the patients. A Neonatal Intensive Care Unit (NICU), also known as an Intensive care nursery (ICN), is an intensive care unit specialized in the care of ill or premature newborn infants. This unit monitors the vital parameters of the child by using sensors. Neonatal Incubator is self-contained unit in NICU which ensures the ideal environmental conditions for the neonates. This also protects the infant from infection, allergens, excessive noise or light that can cause harm. It can regulate air humidity and temperature to maintain the integrity of skin of the neonates. Neonatal mortality in India accounts for nearly 50% of infant mortality. The prominent reason for this is lack of neonatal monitoring facilities in small villages and towns and due to improper monitoring methods. These factors have lead to the death of new born in many situations. In current method the nurse or a doctor need to attend periodically to the newborns and it is a time consuming process. To avoid this, the proposed system allows live monitoring of the parameters over the Internet which improves the quality of information in the neonatal healthcare. Many of the incubator structures contains the temperature and other parameters displayed on the screen, which is fixed to the incubator system. In the maternity ward, the doctors or nurses should be monitoring health condition of infants once in every hour or vice versa. The presence of a doctor or a nurse is always required and they need to continuously monitor the health status of an infant in the incubator. This will not be accurate in taking care all the time, sometimes due to human negligence demise can happen. And in the present incubator systems accumulated statistics from the sensor cannot transfer to the far away locations and the incubator device can't manipulate data from the remote locations.

II. Existing Method

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III. Proposed System

In the proposed Neonatal Intensive care unit system the various parameters like temperature, humidity, light intensity level in the incubator, gas leakage and pulse rate of the child are monitored over the Internet. If the monitored data crosses its limit, this will be indicated to the doctor, nurse or any concerned person through message. The Internet of Things offers a concrete platform to connect all the resources and helps to improve the quality of life.

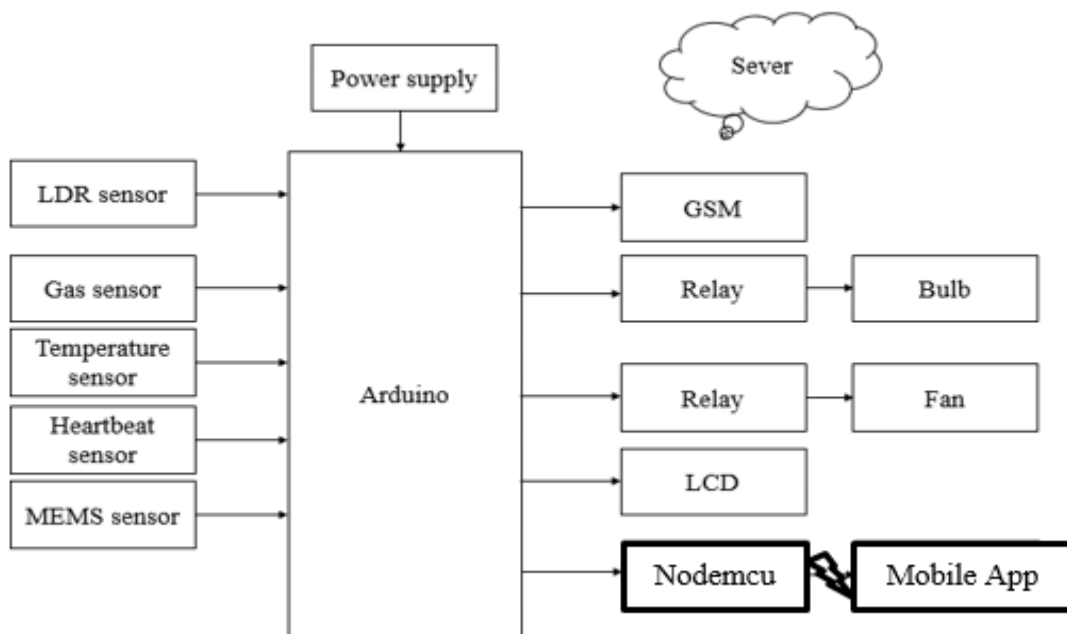
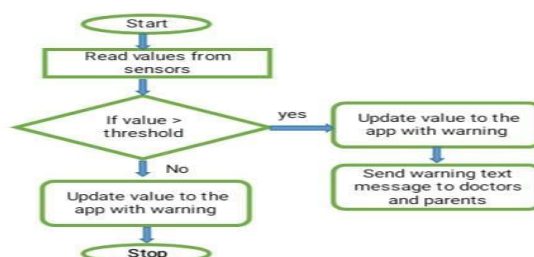


Fig: 2. Block Diagram of Proposed System.

III(a). Working of Proposed System



In the proposed system, the various parameters like temperature, light intensity level in the incubator, gas leakage and pulse rate of the child are monitored over the Internet. If the monitored data crosses its limit, this will be indicated to the doctor, nurse or any concerned person through message. The message will sent using GSM module as an alert message. The temperature , gas, heartbeat ,LDR sensor values will display on mobile application. In this relay module is used to supply power to appliances such as light and fan when triggered by Arduino. Node MCU is serially connected to the Arduino to display the sensor data in mobile application and can be shown in graphical representation.

IV. Hardware Results

The hardware IOT architecture of NICU monitoring system is shown in figure 4.1 in which all the above shown sensors are shown in table (1) are embedded and programmed with suitable instruction sets in Embedded C.

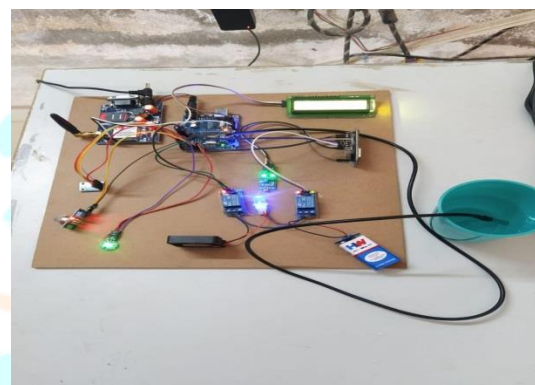
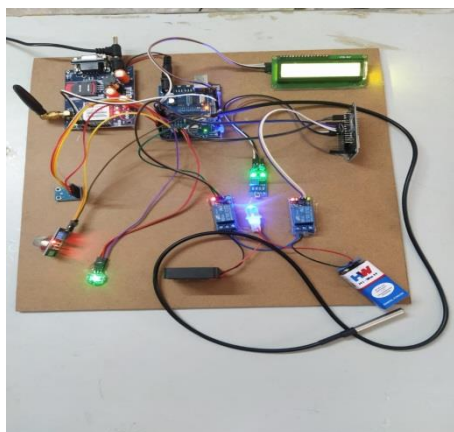


Fig: 4.1. Design OF Hardware IIOT architecture

Fig: 4.2. Implementation of TEMP sensor

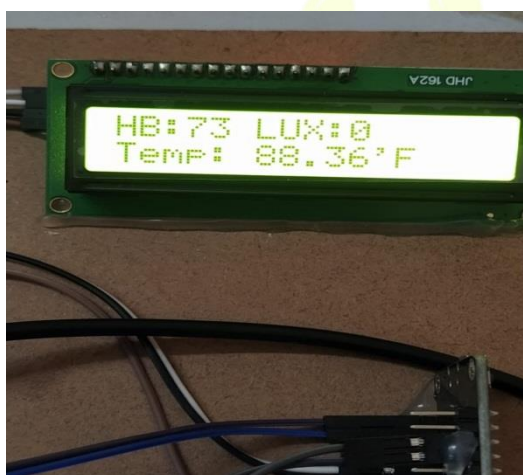


Fig: 4.3. Displaying of sensor values in LCD

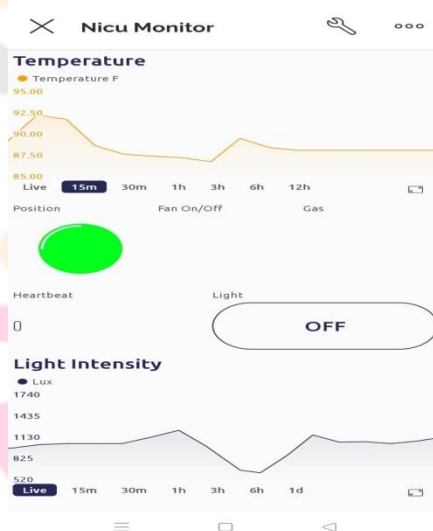


Fig: 4.4. Displaying of values in Blynk App



Fig: 4.5. Graphical representation of Temp sensor values Fig:4.6.Graphical representation of LDR sensor values



Fig: 4.7. Implementation of MEMS sensor to find angular displacement

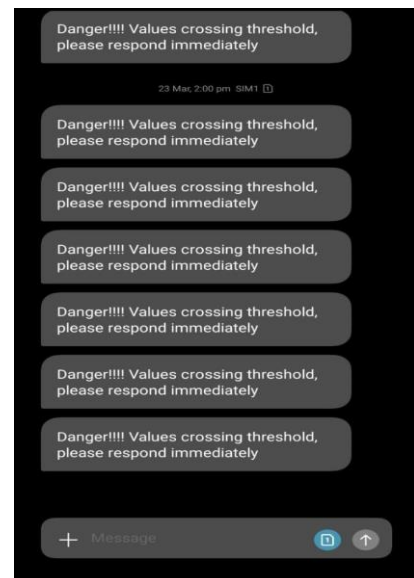


Fig: 4.8 Alert messages through GSM module

V. Conclusion

According to 'Mobi Health News', by 2020 about 4 million patients around the world will be remotely monitoring their health through IOT. WHO expects that within next 30 years, more than 2 billion population will be more than 65 years of age expanding space for growth in healthcare IOT ecosystem. We are still on the runway and are yet to experience a lot of advancements in the healthcare industry, which IOT practitioners have been seamlessly preparing. The only disadvantage of using IOT is risk of losing privacy. As devices from different manufacturers will be interconnected, the issue of compatibility in tagging and monitoring increases. The IOT is a diverse and complex network. Any failure or bugs in the software or hardware will have serious consequences which need to be resolved. By overcoming some of the limitations, IOT offers a great platform for real time monitoring of parameters from the patients and also it improves the quality of information in healthcare monitoring. Proposed system will make the doctor's duty easier. Monitoring of newborn health parameters can be done efficiently.

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