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NEWBORNS NEONATAL INTENSIVE CARE UNIT FOR PRE-MATURE INFANT BASED ON IOT

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ABSTRACT

We report the design and implementation of an affordable bedside device, Neo is capable of acquiring vital data in real time by integrating with diverse devices connected to newborns in neonatal intensive care units (NICUs).

NICUs are equipped with multiple vital sign monitoring devices that are connected to the premature newborn.An NICUs is a device consisting of a rigid box-like enclosure in which an infant may be kept in a controlled environment for medical care. An infant incubator provides stable levels of temperature, relative humidity and oxygen concentration The relative humidity should follow set values according to the number of incubation days. In this smart NICUs an infant's data will be sent through via Phone or PC by doctor/care taker.

Keywords

Neo, vital data, networks in intensive care units (NICUs), monitoring devices, premature newborn, few gigabytes of data.

1 INTRODUCTION

Every year in the India more than 3.5 million infants are admitted to neonatal intensive care units (NICUs) where, in addition to experiencing life-saving treatments, they are exposed to a chemical-intensive hospital

environment during a developmentally vulnerable period.

Prematurity, particularly birth at gestational age < 32 weeks and weight < 1500g, is associated with a particular behavioural phenotype characterized by inattention, anxiety, and socialization difficulties.

Alterations in the developmental trajectory of the cerebral cortex as opposed to focal brain injury are thought to lead to behavioural morbidities associated with preterm birth

Whether hospital-based exposure to phthalates influences behavioural development of NICU graduates has not been evaluated previously.

2 MATERIALS AND METHODS

2.1 Hardware Requirement:

a) Arduino Uno

Fig 1: Arduino uno

Arduino/Genuino Uno is a microcontroller board based on theATmega328P. It has14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analogy inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker withyour UNO without worrying too much about doing something wrong, worst-case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0.

2.1.1 INPUTS METHOD

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digital write (), and digital read () functions. They operate at 5 volts. Each pincan provide or receive 20 mA as recommended operating condition and has an internal pull- up resistor (disconnected by default) of 20- 50k ohm. Maximum of 40mAis the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB- to-TTL Serial

chip.

- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach interrupt () function for details.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog write () function.
- SPI: 10 (SS), 11

(MOSI),12

(MISO),13

(SCK).These pins support SPI communication using the SPI library.

- LED: 13. There is a built-in LED driven by digital pin 13. When the pin is HIGH

value, the LED is on, when the pin is LOW, it's off.

- TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to5 volts, though is it possible to change the upper end of their range

using the AREF pin and the analog reference () function.

There are a couple of other pins on the board:

- AREF. Reference voltage for the analogy inputs. Used with analogy Reference ().
- Reset. Bring this line LOW to reset the microcontroller. Typically, used to add a reset button to shields which block the one on the board.[1]

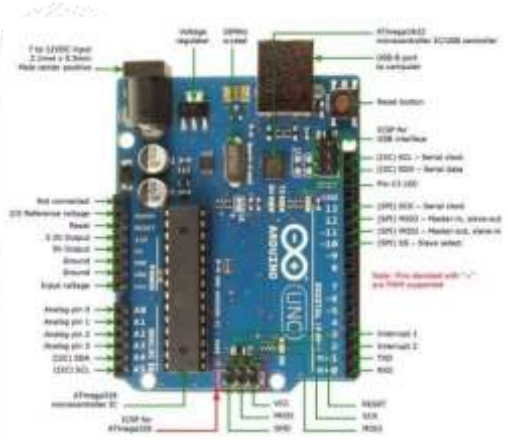

Fig 2: Arduino inputs

b) LCD Display

A **liquid-crystal display** (**LCD**) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock.

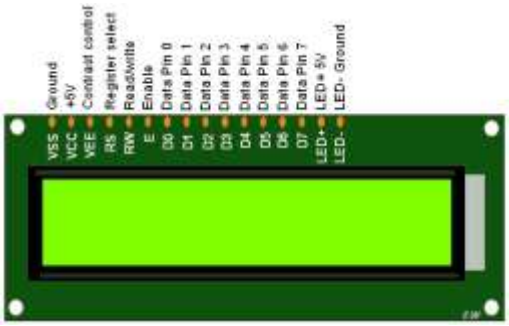

Fig 3: Liquid Crystal Display

c) Buzzer

An Arduino buzzer, also known as a piezo buzzer, is a small speaker that can be connected to an Arduino to produce a tone at a set frequency. Buzzers are often used as beepers in systems, alarm devices, timers, security systems, and to confirm user input.

Fig 4: Buzzer

d) Temperature sensor

A temperature sensor is a device that detects and measures hotness and coolness. Sensors are used in medical devices within intensive care units, hospital wards.

Fig 5: Temperature Sensor

e) Wet/Moisture detection sensor

A Wet/Moisture sensor is a device that detects moisture whether the baby is urinated or not Sensors are used in medical devices within intensive care units, hospital wards.

Fig 6: Wet/Moisture Detector

f) Heart beat sensor

The MAX30100 is a sensor that monitors heart rate and pulse oximetry. It uses two LEDs, an infrared (IR) sensor, and a photodetector to measure blood oxygen saturation and heart rate.

Fig 7: Pulse Oximeter

g) Position sensor

The MPU-6050 is a motion-tracking device that combines a 3-axis accelerometer and a 3-axis gyroscope in a single chip. It measures linear acceleration and angular velocity

Fig 8: Position Sensor

h) Noise sensor

Noise sensors monitor noise levels in the environment, such as machine noise, road traffic, and animal sounds. Here we are using noise sensor for detect whether the baby is crying or not

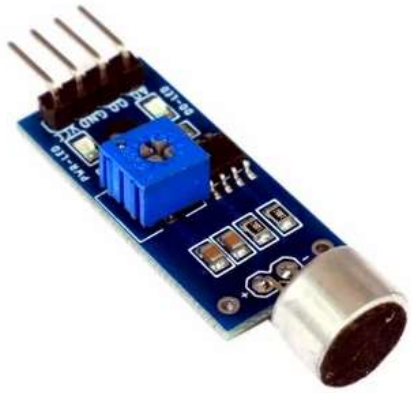

Fig 9: Noise Sensor

Fig 11: NodeMCU

i) Humidity Sensor

It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and sends a digital signal on the data pin.

Fig 10: Humidity Sensor

j) NodeMCU

NodeMCU is an open-source IoT platform that includes firmware and hardware based on the ESP8266 System-on-a-Chip (SoC). It's a low-cost platform that's designed for IoT applications, and includes features like WIFI connectivity, remote monitoring, and control. The NodeMCU is also expandable and has firmware that can be easily extended.

2.2 SOFTWARE REQUIREMENTS:

a) Arduino IDE

b) Embedded C

3 METHODOLOGY

System Design and Planning:

Define the overall system architecture and identify the key components such as Arduino boards, sensors, actuators, and communication modules. Establish the system requirements, including safety features and communication interfaces.

NodeMCU for Real-time Communication: Incorporate NodeMCU for real-time communication between different system components. Develop protocols for message intimation, ensuring timely communication during emergencies

Temperature and Humidity:

To constantly check the baby's temperature and the atmospheric humidity levels

Heart beat and oximeter:

To check the baby's heart beat and the oxygen level. If the heart beat is around 80 – 120 means its normal

Position Sensor:

To check the movement of the baby. If there is a slight change in the position it will beep through the buzzer

Noise Detector:

To detect the whether the baby is crying or not if the crying noise is detected the buzzer will beep

Moisture/Wet Detector Sensor:

This sensor is used to detect the moisture or to Check whether the baby is urinated or not if yes then the buzzer will beep

4 SYSTEM DESIGN

4.1 System Architecture

This diagram represents the system architecture for Neonatal intensive care unit using Arduino sensors and wireless communication:

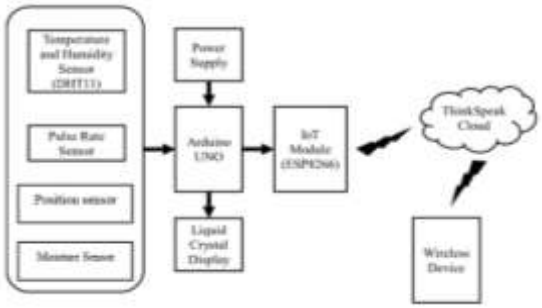

Fig 12: System Architecture

4.2 Flow Chart

The proposed neonatal incubator design consists of 3 sections namely, the terminal device, the network protocols and the monitoring and control of the neonates. The various sensors connected are used for monitoring and controlling the incubator via IoT. The Arduino microcontroller is programmed in such a way to get the output of these sensor and display it on the LCD for monitoring purpose. The values of the sensors are then uploaded in the ThinkSpeak cloud to display it on the wireless device in the receiver side, which is then used for enabling the control of the incubator environment.

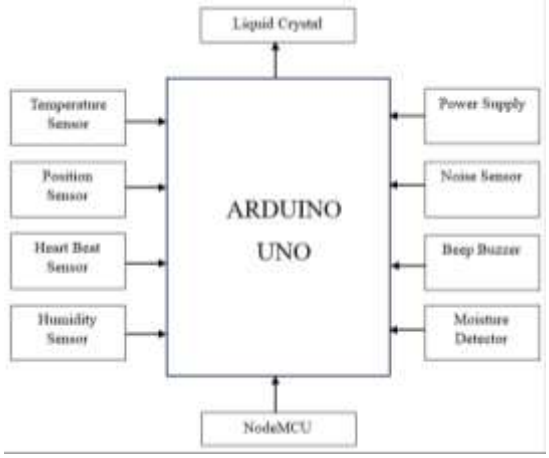

Fig 13: System Flow Chart

4.3 Block Diagram:

The DHT11 humidity and temperature sensor reads the humidity and the temperature in the surroundings of the incubator environment. The optimum value of temperature should range from 36.5°C to 37.2°C. If the temperature value exceeds the preferred range, then the proposed neonatal incubator system alerts the caretaker of the neonate in the incubator via IoT to take necessary actions. Similarly, the light sensor detects the intensity of light penetrating into the incubator and the gas sensor detects if there is any gas leakage inside the incubator and if the value of light and gas exceeds the optimum range, then the system alerts the caretaker regarding this through IoT. Also, the pulse sensor monitors the heartbeat of the neonate and the same alerting system is being executed whenever necessary.

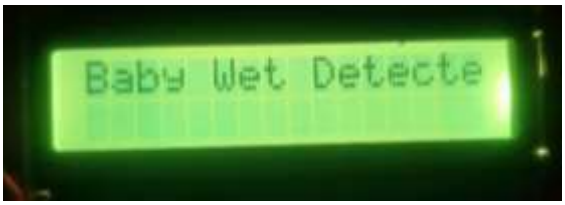

Fig 14: System Block Diagram

4.4 Implemented Picture

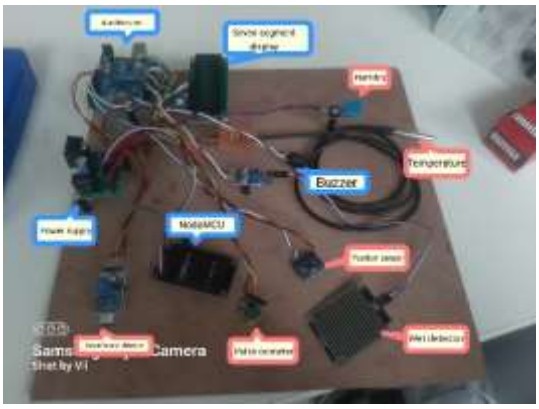

Fig 15: Implemented picture

5 RESULT

5.1 Baby is Crying

When baby is crying it detected by the noise sensors and beeps through the buzzer and gives the warning message through the liquid crystal display

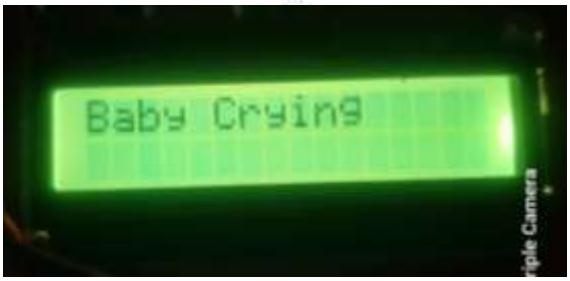

Fig 16: Cry Detected

5.2 More Temperature

When baby's temperature exceeds the limits, the buzzer will beep and gives the warning message through the liquid crystal display

Fig 17: More temperature Detected

5.3 Position is Changed

When the baby Position is changed then the buzzer will beep and gives the warning message through the liquid crystal display

Fig 18: Baby Position is Changed

5.4 Wet/Moisture Detected

If the baby gets urinated then sensors sense the moisture and beeps through the buzzer and gives the warning message through the liquid crystal display

Fig 19: Moisture is Detected

6 REFERENCES

1). V. Hall, E. Geise and N. H. Kashou, "The IncuLight: Solar-powered infant incubator," IEEE Global Humanitarian Technology Conference (GHTC 2014), San Jose, CA, 2014, pp.223-226.

2). L. Liu, Lilin Du and A. Kolla, "Wireless communication integrated hybrid active noise control system for infant incubators," 2016 IEEE Signal Processing in Medicine and Biology Symposium (SPMB), Philadelphia, PA,2016, pp. 1-6.

3). M. Shaib, M. Rashid, L. Hamady, M. Arnout,
I. E. Majzoub and A. J. Zaylaa, "Advanced portable preterm baby incubator," 2017 Fourth International Conference on Advances in Biomedical Engineering (ICABME), Beirut, 2017, pp. 1-4.

4). A. Widianto et al., "The effect of moving load on remote weight monitoring system for simple infant incubator," 2017 International Conference on Broadband Communication, Wireless Sensors and Powering (BCWSP), Jakarta, 2017, pp. 1-4.

5). Revathi.M, Saranya.M, Priyadharshini.M, Risitha.K, Gowri shankar. J, "Design and implementation of newborns neonatal intensive care unit for premature infant based on IOT," International Journal of Engineering Research & Technology (IJERT), 2023, pp1- 4

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