REMOTE INTELLIGENT INFANT INCUBATOR

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Abstract

A neonatal baby incubator is an enclosed device that provides a highly regulated environment for the intensive care of newborn babies who have not yet reached full term. Most infants delivered before 37 weeks of pregnancy don't survive because they don't get primary care, including keeping warm. This project offers a practical, low-cost plan for an embedded device to monitor newborns in an incubator in real time.

Incubators use to increase newborn survival worldwide by keeping babies warm and preventing them from overheating. so that survival of the infants can be done in a effective way. In this project we are going to use Micro controller and different parameters like temperature, humidity, heartbeat, oxygen levels, blood pressure etc., can be analyzed using analog or digital sensors, and Wi-Fi module thereby whole data of baby is sent to the Mobile/System through Wi-Fi Module thereby providing quick access to the doctor /Nurses/Patient relatives. The basic objective of the project is to provide constant temperature is around 36.5- 37.2$^\text{O}$ C, normal heart rate, detecting hazardous gas, humidity levels, motion of the baby as it is required baby as in mother's womb.

Keywords: Thingspeak, Arduinouno Micro controller, sensors..

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1. INTRODUCTION

Embedded systems are miniature computer subsystems built to perform a narrow range of control tasks inside a more extensive system, often under strict real-time computing requirements. Compared to a desktop PC, embedded as part of a complete device, it frequently incorporates hardware and mechanical pieces. Many items in everyday usage are under the direction of embedded systems built to fulfil a single, specified purpose. Engineers working on the product's design may tweak it to improve its size, cost, dependability, and performance. Transportation, fire protection, military, security, and medical applications may all greatly benefit from the deployment of embedded systems, whether in the form of an alarm system tracking suspicious behaviour or a data collection system keeping tabs on a patient's heart rate to determine their overall health. Additional consumer electronics examples include portable computers, PDAs, GPS, home automation systems, home temperature monitoring systems, etc. Arduino is the most popular open-source hardware and software platform. The firm provides an array of software, hardware platforms, and documentation, allowing almost anybody to experiment with technology and express their individuality. ThingSpeak is a free and public data hub for IoT devices. Thing Speak a comprehensive API, so your gadget or app can talk to it. You have the option of making your information public or keeping it private. To further examine and act upon your facts, try Thing Speak.

INTERNET BASEDINCUBATOR

Constructing a DAS that can gather the required data from the sensors at the proper speed and time and upload and record the values on an external server through the internet is the primary objective of creating an internet-connected incubator. To allow remote monitoring of system values without specialised hardware by providing concise, human-readable data summaries. A user may also be capable of identifying the issue. Sensor values may be sent immediately to a data computer or mobile phone over a local low-cost local area network (LAN).LAN makes the data conveniently accessible and controllable from any internet-connected personal computer.
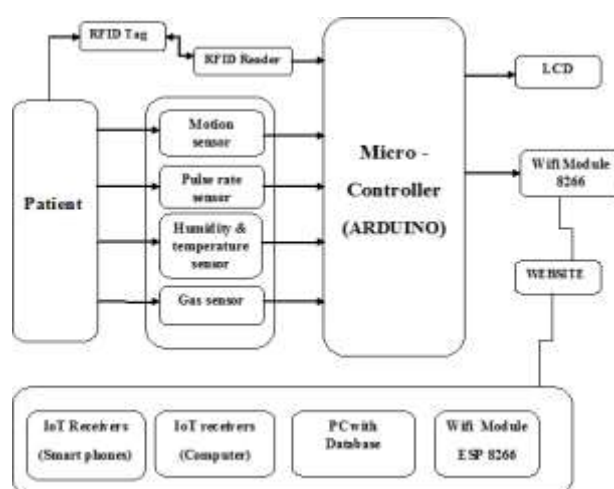
A) BLOCKDIAGRAM

Figure 1.Block diagram

B) Benefits

A remote intelligent newborn incubator's advantages include: Instantly displaying information concisely, intelligibly, and readable so that ready to be digested.

Deliver on-demand to the operator's PC a log of events stored on the server.

In an emergency, contact the operator through their work computer or mobile device by email or short message service (SMS).

Doctors or nurses can keep an eye on how a newborn is doing anywhere.

C) Limitations

There are a few challenges to creating a small intelligent infant incubator, such as The most significant limitation is "Security," as an incubator system with internet connectivity and an external server acting as primary memory risks having sensitive information about the baby and real-time sensor readings fall into the wrong hands (Hackers), which could have catastrophic financial and human consequences.

Today's internet-enabled embedded devices use high-end peripherals and large software stacks, which increase power consumption and shorten battery life.

Detailed Description of the Arduino UNOProcessor (D)

Based on the Microchip ATmega328P microprocessor, Arduino. Cc created the Arduino UNO, an open-source microcontroller board. Input/output (I/O) digital and analogue pins let the board connect to other circuits or extension boards (shields). There are 14 digital pins and six analogue pins on the board, and it can be programmed using a type B USB connector and the Arduino IDE (Integrated Development Environment). It works with input voltages between 7 and 20 volts, so that you can use a USB cable or a 9-volt battery to power it. It's a lot like the Arduino Leonardo and Nano, too. The hardware reference design download from the

Arduino website released under the Creative Commons Attribution-Share, similar to 2.5 licences. Some versions of the hardware's layout and manufacturing files are also accessible. "Uno" was selected to commemorate the launch of Arduino Software (IDE) 1.0 since it means "one" in Italian. There have been several revisions to the Arduino platform since its inception with the Uno board and the 1.0 release of the Arduino Software (IDE). The ATmega328 on the Arduino Uno has a bootloader coded inside it, so new code is uploaded to it without needing a separate hardware programmer. The device uses the standard STK500 protocol for its communications. The FTDI USB-to-serial driver chip is likewise absent from the Uno, making it distinct from all other boards before it. A USB-to-serial converter based on the Atmega16U2 (Atmega8U2 up to version R2) instead. (Atmega8U2 up to version R2) That was modified to function as a serial-to-USB adapter.

E) Features of the Arduino UNO

• Shields will soon work with 5V AVR boards and 3.3V Arduino Dues.

• The second pin is an unconnected spare for use in the future.

The Atmega 16U2 (Atmega8U2 up to version R2) configure as a USB-to-serial converter, and the RESET circuit strengthens.

To facilitate entering DFUmode, the 8U2 HWB line has been pulled to the ground by a resistor on the Uno board revision 2.

The memory on an Arduino Uno is 32KB. It has 1KB of EEPROM and 2KB of SRAM.

The Arduino operates at 16MHz.

USB support is the most helpful feature of the Arduino Uno. This implies that controlling Arduino from a computer is possible and that data transfer between the two is simplified.

An external source or USB port may power this. If we must rely on an external power source, we can provide anywhere

from 6 to 20 volts. Powering an Arduino requires a 5V supply.

Inputs and outputs are made using Uno's 14 digital pins. PWM output is available on 6 of the 14 available pins. There are six available pins for analogue input.

An Arduino board may use either the 12C bus or SPI buses to communicate with other devices. The Arduino software is pre-loaded with the wire library for 12C and the SPI library for SPI communication. Rev 2 Uno boards have a resistor to help enter DFU mode by connecting the 8U2 HWB line to the ground.

An Arduino Uno has 32KB of memory. It comes with 2KB of SRAM and 1KB of EEPROM.

Arduino's clock speed is 16 MHz. The most beneficial aspect of the Arduino Uno is its USB connection. A personal computer may serve as an Arduino's command centre, and that data accessible transferred between the two. You may plug in a USB cord or use an external power supply to power this. If we have to use an external power source, we can provide voltages between 6 and 20 volts. An Arduino needs a 5V power source. The Uno has 14 digital pins that use either inputs or outputs. There are 14 output pins in total, and 6 of them use for PWM output. There are six analogue input pins available. The Arduino board supports both the 12C and SPI protocols for data transfer. The Arduino software has a wired library for 12C and an SPI library for SPI communication.

LITREATURESURVEY

The Neonatal Intensive Care Unit (NICU) now has a web-based real-time operation, administration, and monitoring system for measuring the temperature and humidity inside incubators through the intranet. Each incubator in our test setup has its own temperature and humidity sensor and measurement module linked through an RS485 connector to a central board that serves as a web server. For users to access the system from any Internet-connected personal computer in the hospital, the signals send using standard web-based TCP/IP. The RS485 port on the web-server board receives temperature and humidity readings from the measurement modules, and the system uses this information to generate a web page. From a desk in the neonatal intensive care unit, the system administrator can keep tabs on everything happening in the incubators within their purview. If the system detects anything unusual, it may be programmed to sound alert or flash a light on the incubator's linked measurement module. It will be more convenient and ensure real improvements in reaction times to issues requiring intervention if the system sets up with many incubators linked to a central supervisory monitoring station.

2. METHODOLOGY

A sensor may measure a physical quantity and then communicate that data as a signal to an observer or an instrument. For instance, the temperature translates into the expansion and contraction of a liquid, which shows on a calibrated glass tube in a mercury-in-glass thermometer. A voltmeter uses to read the voltage output from a thermocouple. Most sensors are calibrated to recognized standards to ensure accuracy.

In our custom-built project incubator, we installed various sensors that measure humidity and temperature, heart rate, gas levels, and mobility.

A) Temperature and Relative Humidity Detector

In this case, we monitor relative humidity and temperature via a DHT11 sensor. It has an IC on the rear and an NTC temperature sensor (or thermistor) on the front for measuring temperature and humidity. The humidity sensor component consists of two electrodes separated by a moisture-holding substrate and used for taking humidity readings. Humidity affects the substrate's conductivity or the

resistance between these electrodes. The IC monitors the resistance and processes the data so the microcontroller can read it. However, these sensors use an NTC temperature sensor or a thermocouple to get accurate temperature readings.

Essentially, a thermistor is a variable resistor whose resistance varies with temperature. Sintering semiconducting materials like ceramics or polymers yields these sensors by allowing for more significant variations in resistance with just modest shifts in temperature. When the resistance drops as the temperature rises, it is said to have a "Negative Temperature Coefficient," or "NTC."

Specifications:

- TemperatureRange   :0-60 ^{0}C
- HumidityRange   :20-95%RH
- OperatingVoltage   :3-5V
- HumidityResponse Time   :<60sec

A) GASsensor

A wide range of gases in the air, including NH3 and NOx, alcohol, benzene, smoke, and carbon monoxide.Suitable for the workplace or manufacturing. The MQ135 gas sensor is susceptible to ammonia, sulphide, benzene, steam, smoke, and other toxic gases. Its low price and versatility make it an excellent option for air quality monitoring.

The MQ-135 Sensor Has: a Huge Detecting Range

High sensitivity and quick reaction time

low-cost, durable, and dependable

Detect/measure NH3, NOx, alcohol, Benzene, smoke, CO2, etc.; operating voltage is +5V; NH3 detection range: 10-300 ppm; Benzene detection range: 10-1000 ppm; Alcohol detection range: 10-300 ppm

The detector of Indoor Air Pollution and Air Pollution in Industrial Settings Pollution monitoring in the field.

B) Pulse sensors include the following features: a biometric pulse rate or heart rate detecting sensor; a plug-and-play design; +5V or +3.3V operation; 4mA current draw; an in-built amplification and noise cancellation circuit; and an operating voltage of +5V or +3.3V.The heart rate/pulse sensor has a straightforward operation. The sensor is bidirectional, having electronics and an LED on one side and an ambient light sensor on the other. This electronic circuitry performs the functions of amplification and noise suppression. A human vein is positioned directly in front of the sensor's LED. A fingertip or the tip of an ear should be positioned exactly over a vein. At this point, the LED will shine a beam of light onto the vein. Only when the heart is pumping can blood flow through the veins, hence, checking blood flow is a good proxy for checking heart rate. The ambient light sensor will collect more light if blood flow is observed, since the blood will act as a reflector. This little difference in incoming light is then evaluated over time to reveal heartbeats.

C)Motionsensor

Using the piezoelectric effect and operating on the basis of the electromechanical principle, vibration velocity sensors are able to measure the absolute vibration of a bearing. Transform the force-induced change in resistance into a 4-20 mA signal. They need a range of -12 to +12, with 0 serving as the reference point, since they are detecting oscillation differences. A piezoelectric sensor picks up the vibrations on the surface. A shock

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sensor may also be used to detect vibrations.

HARDWAREIMPLEMENTATION

Arduino Uno is a kind of Arduino board. It contains 28 pins and an ATmega328 microprocessor. Above, you can see the pinout of an Arduino Uno board. It has a USB port, a power connector, a 16 MHz crystal oscillator, a reset button, an ICSP header, and 14 digital I/O pins, six of which are dedicated to pulse width modulation output pins. A battery, an external adapter, or a USB cable connected to a computer are all options for powering the Arduino board. By providing voltage reference via the I/O Ref pin or the pinVin, this board may function with an external supply of 7–12 volts. The Arduino IDE is by far the most popular environment in which to work with ESP modules, although there are many others. Let's limit our discussion to that, then.

Wi-Fi ESP8266 Module
To avoid damaging the ESP8266 module, only use 3.3V in your circuits. Using 3.7V will cause the module to malfunction. The ESP-01 is best programmed using the FTDI board, which allows for 3.3V programming. It is advised that you get one; however, an Arduino board might do in the meantime. All users encounter the problem of not being able to successfully power up the ESP-01. While being programmed, the module consumes a fair

amount of power; you may supply it using a 3.3V Arduino pin or a simple potential divider. Therefore, a tiny voltage regulator for 3.31 volts that can produce at least 500 mA is essential. One regulator that might be suitable for the task at hand

Applications

Automation of the Home, Wireless Data Logging, Internet of Things Projects, Acquire a foundational knowledge of networking, Electromechanical Mobility, The use of Wi-Fi-connected, Wi-Fi-rechargeable, and Bluetooth-en

PERSPECTIVE ON THE FUTURE

Increasing the number of sensors in the baby incubator may make it more efficient and better. The doctor will learn more about the newborn from this. The ambient room temperature may be monitored by attaching a second sensor to the incubator. The baby's incubator may be outfitted with a signal transmission system that sends vital data to the hospital's main server. Using a Bluetooth module, a developer may create a wireless system to monitor a person's heart rate in real time, with the data then being displayed, recorded, and saved in an Android application. If working parents are interested in seeing their children, we may use this WiFi method to facilitate that. To do this, just develop an Android-based app that provides parents with real-time information on their child's development [7].

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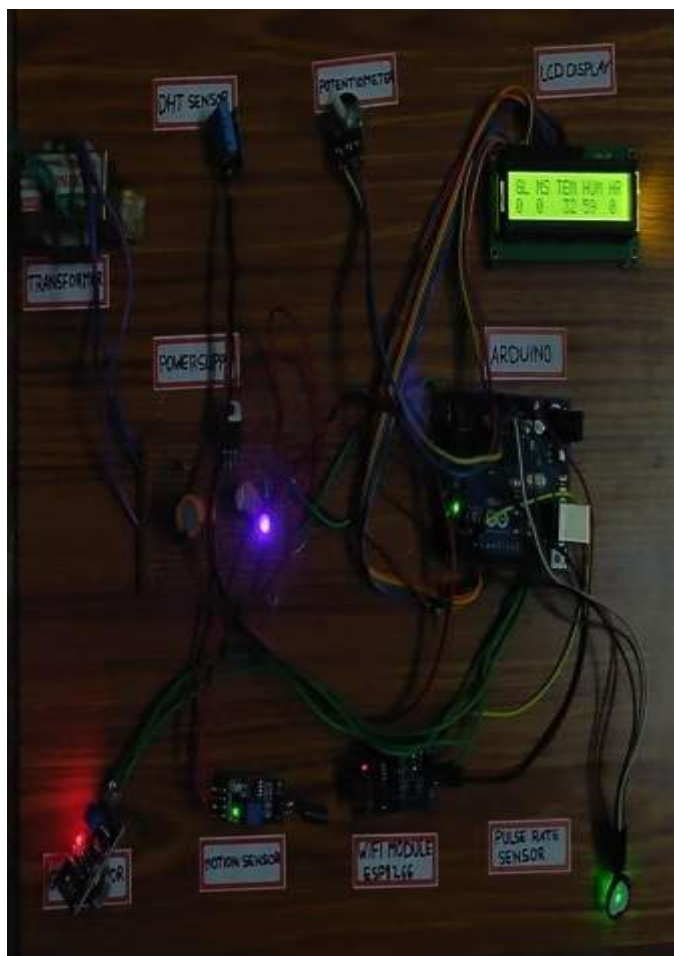
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3. RESULTS

Temperature sensor:
The Following Graph shows the last updated value of temperature of Incubator.

Humidity sensor:
The Following Graph shows the last updated value of Humidity of incubator

Incubator circuit

Heart Rate sensor:
The Following Graph shows the last updated value of Heart rate sensor(BPM) ofIncubator.

Gas sensor:
The Following Graph shows the last updated value of Gas sensor of incubator

Motion sensor:
The Following Graph shows the last updated value of Motion sensor of Incubator.

4. CONCLUSION

To achieve environmental monitoring and control in a newborn incubator, we have suggested an intelligent incubator in this study. Rural communities may benefit from this endeavour. Smaller healthcare facilities may also benefit from this apparatus. This project may efficiently and effectively maintain the room and the chamber temperature. [10]. It will serve as a roadmap for those who want to construct baby incubators.

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