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WEARABLE SENSOR WITH WEB SERVER BASED INCUBATOR MONITORING AND CONTROL MANAGEMENT SYSTEM

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ABSTRACT

The System is mainly focused towards incubator control based on wearable sensor networks pasted on body of the Fetus. The output of the system can be monitored in web server called IoT application can be viewed in wireless communication. One of the most important elements in a newborn's survival is the infant's temperature regulation. Mammals have the advantage of being homoeothermic, meaning that they are able to produce heat, enabling constant body temperature to be maintained. However a preterm newborn infant needs special care because some vital organs and/or biochemical/enzyme systems may not have developed sufficiently, or because the growth of the fetus may have been disturbed, with the result that the infant is unlikely to survive undamaged without special protection. An infant is called preterm if it is born following a gestation period of less than 37 weeks. The preterm infant has several disadvantages in terms of thermal regulation. An infant has a relatively large surface area, poor thermal insulation, and a small amount of mass to act as a heat sink. This system developing towards the automatic heat generator based on fetus body temperature. The DS1820 sensor is used to detect the body temperature of the fetus. Based on the temperature output the microcontroller is varying the heating point of the heater. The parameters of the neonate such as body temperature and heart pulse levels are monitoring through wireless web server (IoT). The system also introduces the smart communication system for authorized entry. The smart tag is fixed in authorized visitor token. The emergency alert is fixed in the incubator room. The emergency alert is activated by the controller when the people are entered inside the room without token.

Keywords*: wearable sensor, Incubator autonomous and wireless application protocol (IoT)*

1. INTRODUCTION

One of the most important elements in a newborn's survival is the infant's temperature regulation. Mammals have the advantage of being homoeothermic, meaning that they are able to produce heat, enabling constant body temperature to be maintained in 370C. However a preterm newborn infant needs special care because some vital organs and/or biochemical/enzyme systems may not have developed sufficiently, or because the growth of the fetus may have been disturbed, with the result that the infant is unlikely to survive undamaged without special protection. An infant is called preterm if it is born following a gestation period of less than 37 weeks. The preterm infant has several disadvantages in terms of thermal regulation. An infant has a relatively large surface area, poor thermal insulation, and a small amount of mass to act as a heat sink. The infant has little ability to conserve heat by changing posture and no ability to adjust clothing requirements in a response to thermal stress. Responses may also be hindered by illness or adverse conditions such as hypoxia (below normal levels of oxygen). Heat exchange between the environment and the infant is like any physical object and its environment.

1.1 Existing Method

Temperature and humidity are the main parameters to be controlled in a hatching system for incubation process. Maintaining of these highly sensitive natural elements is one of the major steps to breed healthy chicks in a hatching process. On the basis of providing an order of standardizing the operation and care to monitor the desired temperature and relative humidity, this paper proposes a system of incubation for the hatching of turkey birds. This incubation system is developed based on ATmega32A microcontroller using DHT22 temperature and humidity sensor. For monitoring purpose, LCD 20x 4 displays is used as well as an Android application.

Problem Statement

- Temperature and humidity parameters are monitored.
- There is no automation for controlling the heat and no alert for unauthorized human entry.

1.2 Proposed Method

The device may include an AC powered heater; circulate the warmed air, a control valve through which oxygen may be added, and access ports for nursing care. With the technology available currently, incubators control systems based on wearable sensor cum microcontroller to create and maintain the ideal microclimate for the preterm neonate. The parameters.

2. LITERATURE REVIEW

Temperature and humidity are the main parameters to be controlled in a hatching system for incubation process. Maintaining of these highly sensitive natural elements is one of the major steps to breed healthy chicks in a hatching process. On the basis of providing an order of standardizing the operation and care to monitor the desired temperature and relative humidity, this paper proposes a system of incubation for the hatching of turkey birds. This incubation system is developed based on ATmega32A microcontroller using DHT22 temperature and humidity sensor. For monitoring purpose, LCD 20x 4 displays is used as well as an Android application. For the feature of user control system, button and Android application were used. This incubator is also very user-friendly and temperature and humidity.

3. SYSTEM FUNCTION

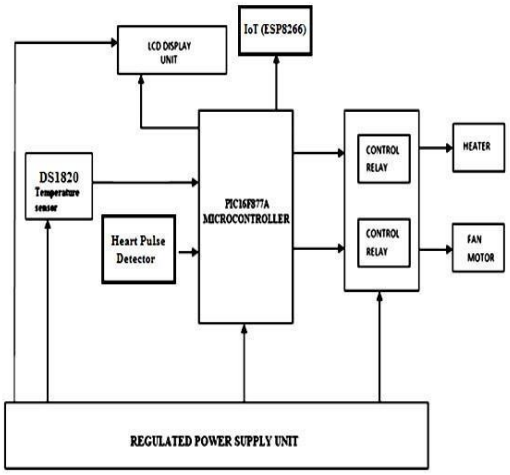

Fig.1 block diagram of the system

The proposed neonatal incubator system is shown in figure 3.1. This system consists of wearable sensor such as heart pulse sensor (IR probe), LM35 Temperature sensor, 2X16 LCD display unit, +5V regulated power supply unit, PIC16F877A microcontroller, wi-fi module ESP8266 heat lamp and DC cooling FAN. The heart pulse sensor consists of IR transmitter and receiver modules. It can be used to sense the heart pulse rate from right finger and converts the IR light pulse rate into electrical pulse signals. All the output of the sensor network is in the form of analog. These signals are applied to the input of PORT A of the PIC16F877A microcontroller.

The PORT A is the ADC (Analog to Digital Converter) port which is used to convert the analog values into digital values. The temperature sensor DS1820 is used because of its linear relationship between the measured temperature and its output voltage. Its output is 10mV for a degree rise in temperature. The sensor senses the temperature of the fetus body heat for controlling the heater level of the incubator.

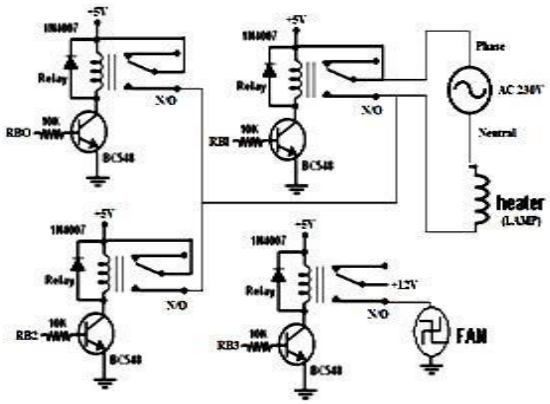

Fig.3 circuit diagram of the heater control

This system also incorporates high temperature (35^0C) and low temperature (25^0C) indication for medical attention in the case of accidental failure of the temperature regulating system. The converted digital values are stored in the memory unit of the microcontroller which is transmitted to web server through wifi module ESP8266. The ESP8266 is a wireless application module which is used to transmit the RF signals in the frequency range of 2.4GHZ ISM Band. The LCD display unit is used to displays the various measurements of the Fetus.

4. POWER SUPPLY UNIT:

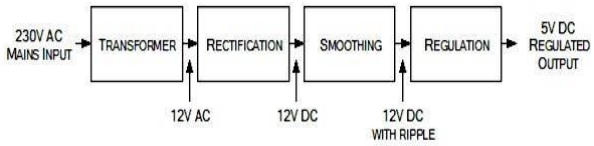

Fig. 3.4: block diagram of the power supply unit system

The transformer used here is a step-down transformer which converts 230v AC into 12V AC. A full wave rectifier made around the diodes converts the ac supply into a pulsating dc supply. Here the rectifier consists of two 1N4001 silicon diodes which are capable of delivering current up to 1 amp.

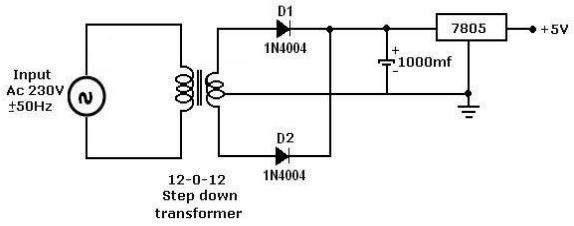

Fig. 3.5 Functional circuit diagram of power supply unit

The ripple content in the rectifier output is smoothened by adding a capacitor filter in parallel to the output. The value of capacitor may be from 1000 to 4700 microfarads. Higher the chosen value more is the filtering. The 12V dc is regulated to 5V dc using a 3-terminal series pass regulator with the input pin (pin1) to output of rectifier, output pin (pin3) to the supply output. The common pin (pin2) is connected to the supply ground. The output of the regulator will be 5volts.

5. PIC MICROCONTROLLER

The PIC controller used in our project is PIC16F877A, the pin diagram of which is shown in figure. It is used to energize and de-energize the contactors during the weld and non-weld periods. The internal timer of the PIC microcontroller is used to set time delay between non-weld period and power cut off to the primary of the welding transformer.

This powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into an 40- or 44-pin package and is upwards compatible with the PIC16C5X.

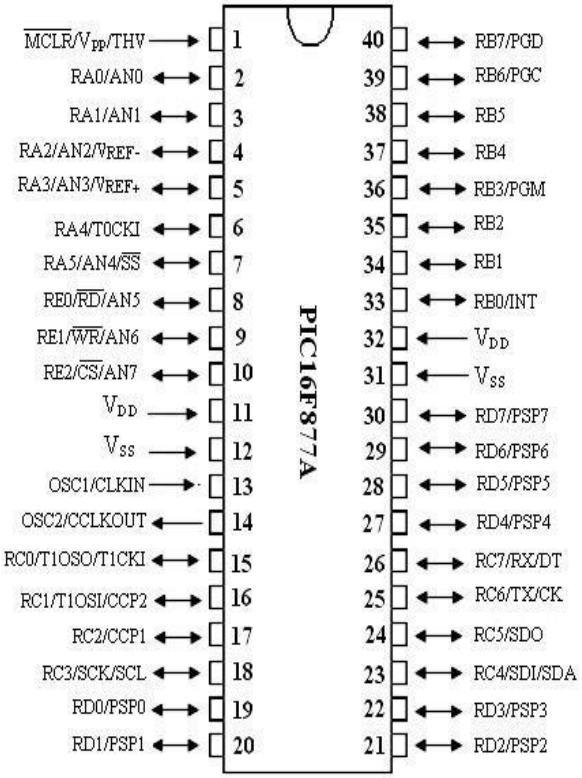

Fig: 4.1 Pin Diagram of PIC16F877A.

The advantages of PIC microcontroller are as follows:

1) Increased reliability through a small part count.

2) Reduced stock levels, as one microcontroller replaces several parts.

3) Simplified product assembly

4) Greater product flexibility and adaptability

5) Rapid product changes or development by changing the program and not hardware.

CPU:

- Only 35 single-word instructions to learn
- All single-cycle instructions except for program branches, which are two-cycle
- Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle
- Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory

PERIPHERAL FEATURES:

- Timer0: 8-bit timer/counter with 8-bit prescaler
- imer1: 16-bit timer/counter with prescaler, can be incremented during Sleep via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules
- Synchronous Serial Port (SSP) with SPI
- (Master mode) and I^2C™ (Master/Slave)

- Universal Synchronous Asynchronous Receiver
- Transmitter (USART/SCI) with 9-bit address detection.

SPECIAL MICROCONTROLLER FEATURES:

- 100,000 erase/write cycle Enhanced Flash program memory typical
- 1,000,000 erase/write cycle Data EEPROM memory typical
- Data EEPROM Retention > 40 years
- Self-reprogrammable under software control
- In-Circuit Serial Programming™ (ICSP™) via two pins
- Single-supply 5V In-Circuit Serial Programming
- Programmable code protection
- Power saving Sleep mode
- Selectable oscillator options
- In-Circuit Debug (ICD) via two pins

CMOS TECHNOLOGY:

- Low-power,high-speed Flash/EEPROM technology
- Fully static design
- Wide operating voltage range (2.0V to 5.5V)
- Commercial and Industrial temperature ranges
- Low-power consumption

ESP8266 WIFI MODULE

ESP-12E WiFi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra low power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/BB/RF/PA/LNA, on-board antenna. The module supports standard IEEE802.11 b/g/n agreement, complete TCP/IP protocol stack. Users can use the add modules to an existing device networking, or building a separate network controller.

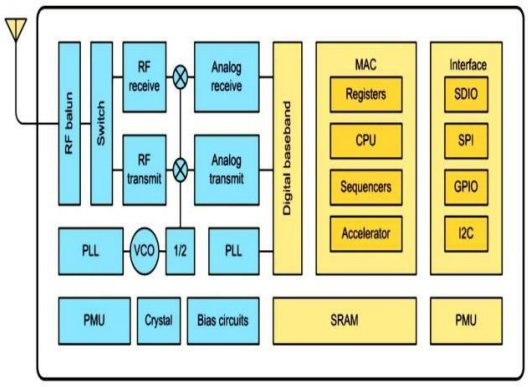

Fig: 4.2 ESP8266EX Block Diagram

6. CONCLUSION

The design accounts for health and safety by providing a safe environment in which an infant is warmed. This is achieved by the use of materials that are non-toxic in the incubators range of operation. Additionally, the ability of components to be sanitized allows for the cleaning of the incubator to maintain a sterile, safe environment for the infant. Also, production of heat is directed away from the infant to ensure that heat in not directly blowing on the infant. The user is protected by the placement of heaters away from the incubator doors and the use of a protection grid over the heater fans. Further, the IncuLight is economically viable. The design achieves this by the use of inexpensive materials found in developed nations. Here, the IncuLight can be produced and, because of its portability, the device can be readily transported to third world environments.

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