

Smart Health Monitoring System for Jaundice Disease in Newborn Babies using IOT

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To Cite this Article

Niteen Vaijnath Kamble, "Smart Health Monitoring System for Jaundice Disease in Newborn Babies using IOT", *International Journal for Modern Trends in Science and Technology*, 6(8): 153-157, 2020.

Article Info

Received on 06-July-2020, Revised on 28-July-2020, Accepted on 03-August-2020, Published on 11-August-2020.

ABSTRACT

Jaundice is a condition that can occur in newborns, within 2-3 days of birth. Jaundice is actually a yellowing of the skin or whites of the eyes'. This is caused by elevated bilirubin levels in the newborn's blood. Jaundice normally appears first on the face and then will move down the body to the chest, abdomen, arms, and legs.

Phototherapy treatment in which UV light that helps to break down the bilirubin in the baby's skin. If a baby is still in the hospital or is readmitted to the hospital, Phototherapy may be administered by placing the baby in a special warmer surrounded by these UV lights. Efficacy of phototherapy depends on the type of light-source, the intensity of light and the area of skin exposed.

KEYWORDS: Phototherapy Treatment, UV Light LEDs, IoT, Wi - Fi Module, Jaundice, bilirubin Level in Blood Sample

I. INTRODUCTION

Most Neonatal jaundice is a condition in infants characterized by the presence of high level of bilirubin. Increased levels of serum bilirubin cause irreversible brain damage and kernicterus in infants. Jaundice occurs in the first two weeks of life in 25% to 60% of full-term newborns, and in 80% of preterm newborns. The phototherapy. It converts bilirubin into water soluble photo-products that can bypass the hepatic conjugating system and be excreted without further metabolism. The clinical response to phototherapy depends on the efficacy of the phototherapy device, as well as the infant's rates of bilirubin production and elimination.

Phototherapy is the use of Ultraviolet Light (UV) for reducing the concentration of bilirubin in the body of infants.

Phototherapy can be delivered using several types of conventional light sources, including daylight, white or blue fluorescent bulbs and filtered halogen bulbs.

In recent years, a new type of light source, light-emitting diodes (LEDs), has been developed and studied as possible light sources for the phototherapy. LEDs are power efficient, portable, with low heat production, not heavy and have a longer life span. Blue LEDs emit a high intensity narrow band of blue light overlapping the peak spectrum of bilirubin breakdown resulting in potentially shorter treatment time. These characteristics of LEDs make them an optimal light source for a Phototherapy device

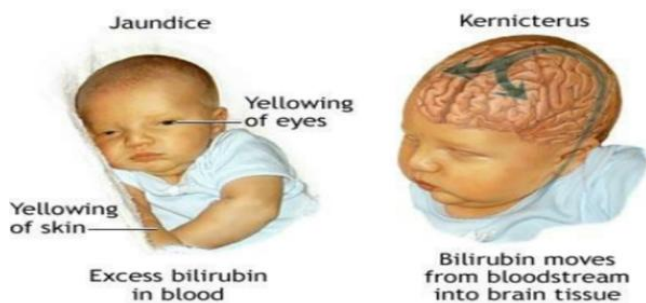


Figure -1: Jaundice Baby Skin Image

II. LITERATURE SURVEY

Commercially available phototherapy systems include those that deliver UV light via fluorescent bulbs, halogen quartz lamps, light-emitting diodes, and fiber optic mattresses. Proper nursing care enhances the effectiveness of phototherapy and minimizes complications. Caregiver responsibilities include ensuring effective irradiance delivery, maximizing skin exposure, providing eye protection and eye care, carefully monitoring thermoregulation, maintaining adequate hydration, promoting elimination, and supporting parent-infant interaction. Ultraviolet (UV) is a form of electromagnetic radiation with wavelength from 100 nm (with a corresponding frequency of approximately 30 PHz) to 400 nm (750 THz), shorter than that of visible light but longer than X-rays. UV radiation is present in sunlight, and constitutes about 10% of the total electromagnetic radiation output from the Sun.

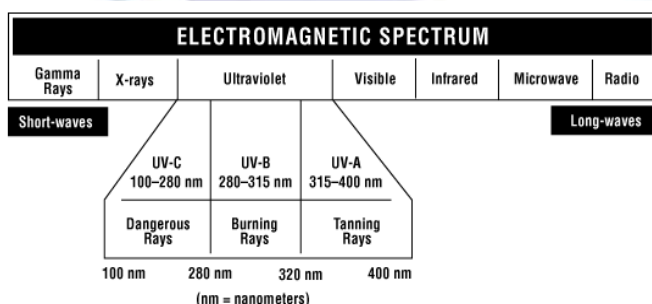


Figure -2: Electromagnetic Spectrum of Light

Table -1: UV Light side Effect on Human body

Sr No	UV Light with wavelength in (nm)	Source	% of UV light Reaches on Earth Surface	Side Effect on Human Body
1	UV - A 315 nm to 400 nm	Sun	95%	1) Skin Cancer 2) Sun spot on skin

				3) Skin Wrinkles
2	UV - B 280 nm to 315 nm	Sun	5%	1) Skin aging 2) Skin Tanning & Burning 3) Damage DNA in Skin cells
3	UV - C 100 nm to 280 nm	Sun	0% Absorb by Ozone layer	1) Able to penetrate the skin and causes Deep Sun Burn 2) Eye irritation

III. SYSTEM ARCHITECTURE

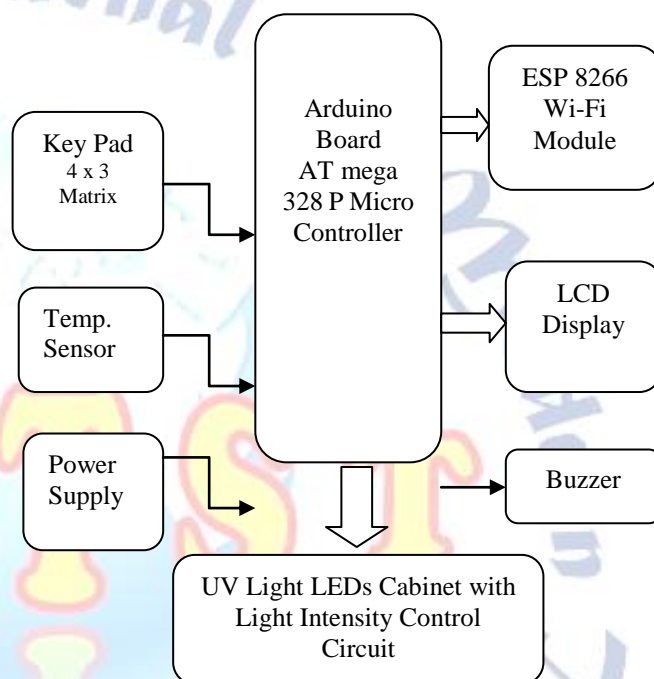


Figure -3: Architecture of UV LEDs System

The IoT Based UV LEDs system used consist of Arduino board with Kay Pad, Temperature Sensor, Buzzer, LCD Display, Wi Fi Module with UV LEDs Cabinet. This system used in Jaundice Treatment in new born babies. It is more effective Treatment other than conventional Treatment.

IV. WORKING OF UV LEDs SYSTEM USING IOT

The doctor checks the result of blood sample of new born babies & the level of bilirubin. As per the report of bilirubin the doctor will inter the value using key pad. The Temperature sensor will sense the temperature of the cabinet of the baby. The Microcontroller will compare the enter value with the Reference Value of the bilirubin. If the Enter value of bilirubin is grater then the Reference Value then it will be critical condition of the Jaundice it may cause liver & Brain problem to the new born babies. Now the Microcontroller If the Enter value of bilirubin is grater then the Reference Value then as

per Higher value of bilirubin it will increase the Light Intensity of the UV LEDs to decrease the bilirubin level. At the same time the LCD Display will display the Reference bilirubin level & Enter bilirubin level Value with the Temperature of Babies Cabinet.

The Same data will obtain using Wi-Fi Module so the Doctors, Nurses can monitor the data on Computer, Laptop & Mobile using the Blynk App using the internet. The Light Intensity Vary from the range of 430 to 490 nm wavelength as per the Value Enter by the Doctor.

Generally the Light Intensity of 470 nm wavelength of blue UV Light more effective in the Treatment.

If the Enter Value of bilirubin level is less than the Reference Value the Data will Display on LCD Display & Wi Fi Module & the Buzzer will start ON & the Micro controller will Turn off the UV LEDs Supply.

Table -2: UV Light Intensity Range used in system

Sr No	UV Light	Range	Light Intensity	Remark
1	Blue light UV LEDs	430 to 490 nm	470 nm	Blue LED lights have a narrow spectral band of high-intensity light that overlaps the absorption spectrum of bilirubin.

Table -3: Bilirubin Test Value of New born Babies

Sr No	Bilirubin Test Result from Blood Test of Newborn Baby		Age of Newborn Baby in Hours	Remark
	Normal Value (mg/dL)	Critical Value (mg/dL)		
1	0.8 to 10.0	> 10.0	Less than 24 Hours Old	Phototherapy (UV Light) Treatment Required in critical Condition
2		> 15.0	24-48 Hours Old	
3		> 18.0	48-72 Hours Old	
4		> 20.0	Older than 72 Hours	

Table - 4: Bilirubin Test Value of New born Babies age in Hours

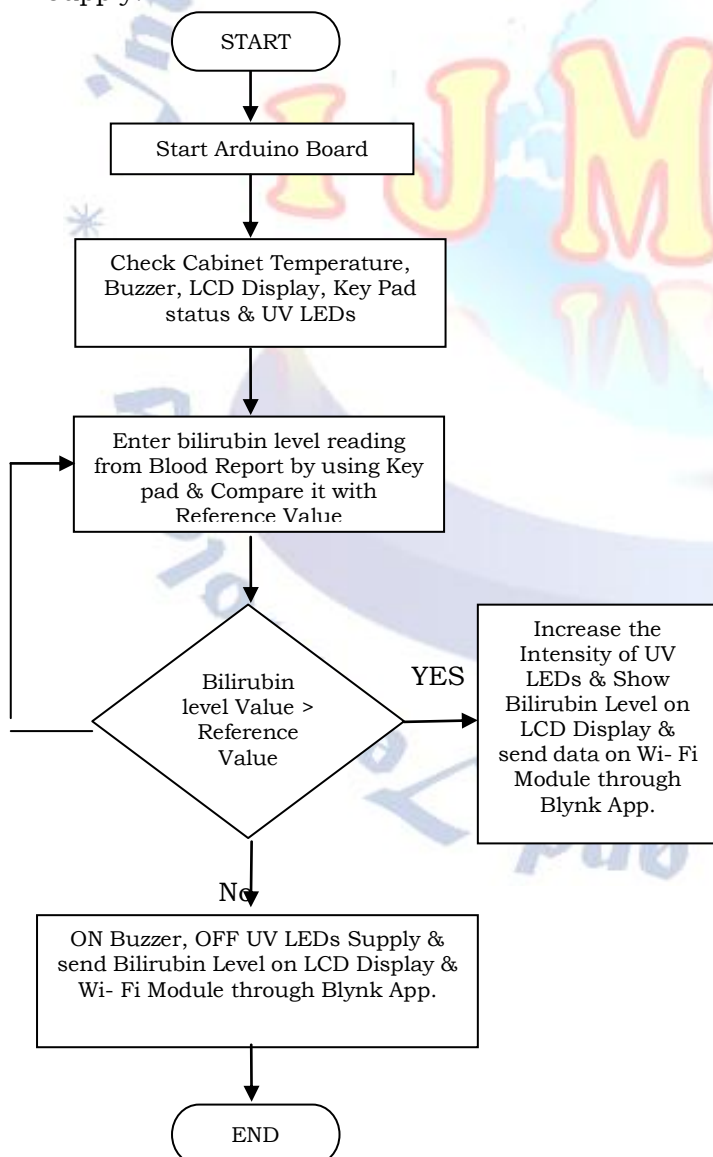
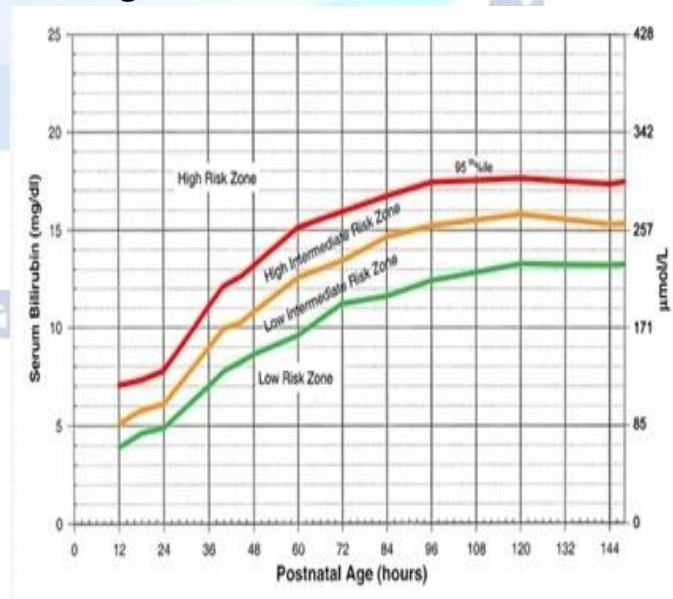
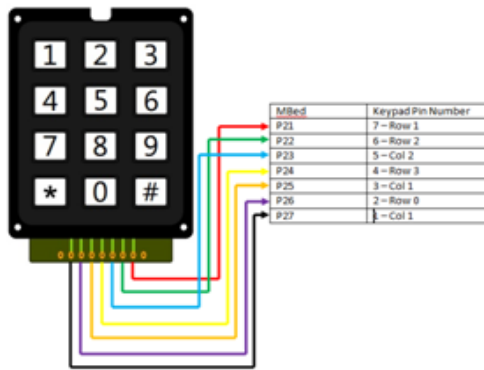


Figure -4: Flow chart of UV LEDs System

V. DESCRIPTION OF HARDWARE COMPONENTS

1. KEY PAD:

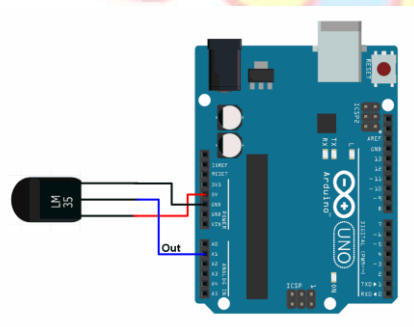
Figure -5: Key Pad Connection pins to interface Arduino Board



This Matrix Keypad 4 X 3 has 12 buttons, arranged in a telephone-line 3x4 grids. The keys are connected into a matrix; hence only 7 microcontroller pins (3-columns and 4-rows) are required to scan the pad.

2. TEMPERATURE SENSOR (LM 35):

Figure -6: LM 35 sensor interfacing with Arduino Board



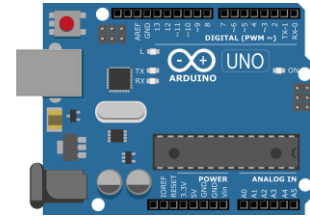
LM35 is a temperature sensor which can measure temperature in the range of -55°C to 150°C . It is a 3-terminal device that provides analog voltage proportional to the temperature. Higher the temperature, higher is the output voltage.

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. Since it has Linear + $10.0\text{ mV}/^{\circ}\text{C}$ scale factor it is very easy to calculate temperature value.

It can be used with single power supplies, or with plus and minus supplies

3. ARDUINO BOARD (AT MEGA 328P):

Figure - 7: Arduino Board (At Mega 328 p)

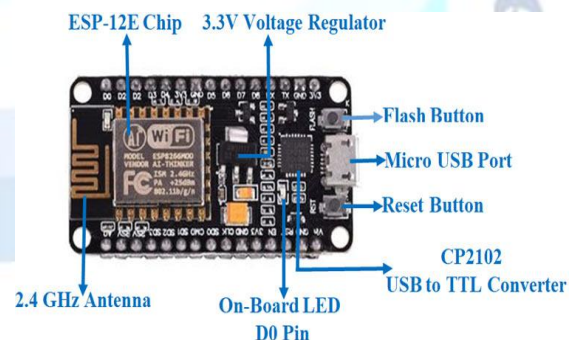


The ATMEGA328P-PU is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega328P-PU achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The ATmega328P-PU AVR is supported with a full suite of program and system development tools including: C Compilers, Macro Assemblers, and Program Debugger/Simulators, In-Circuit Emulators, and Evaluation kits.

4. ESP 8266 WI FI MOCULE:

Figure -8: Pin out Diagram of ESP 8266

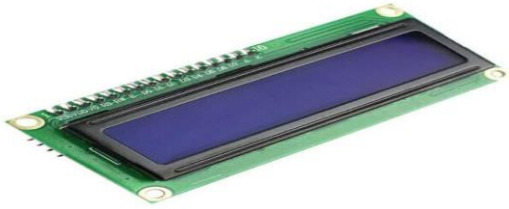


Node MCU ESP8266 development board comes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. Node MCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects. Node MCU can be powered using Micro USB jack and VIN pin

(External Supply Pin). It supports UART, SPI, and I2C interface.

5. LCD DISPLAY (16X2):

Figure -9: 16 x 2 LCD Display



LCD 1602 Parallel Display Module - It is a dot matrix type Liquid Crystal Display. It can display up to 16 characters in 2 rows. It has parallel ports to support multiple I/O read and write operations. It can display the ID of the registered fingerprint while matching.

4. BUZZER:

Figure -10: Pin out Diagram of Passive Buzzer



An Active Buzzer Alarm Module for Arduino is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Just like what you are viewing now, it is 3.3V-5V DC Electronic Part Active Buzzer Module.

Using top quality material, it is durable in use. An active buzzer rings out as long as it is electrified. Compared with a passive buzzer, it is a bit expensive but easier to control.

Typical uses of buzzers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

VI. MODULES IMPLEMENTATION

1) <Key pad. h> - It is a library for supporting the 4 Channel push button switch. It can program the buttons to activate different functions. Navigation button and Accept button are programmed to perform their functions.

2) <ESP 8266 Wi Fi.h> - It is a library for the Node MCU board. It allows the module to connect to the

internet via WiFi. It takes SSID and password as input in the program. It can connect to servers for sending and receiving messages.

3) <Blynk Simple Esp8266 .h> - It is a library to connect the system to the Blynk server. It can send the access logs to the Blynk Cloud. It can send notification for unrecognized fingerprints to the mobile phone application.

4) <Liquid Crystal. h> - It is a library that works on the text based LCDs. It can display the result after matching. It displays the current status of the program. It can auto scroll and clear text when required. It displays the serial input taken from the 4 button switch and also manages the underscore cursor.

VII. CONCLUSIONS

The Blue LED UV Light Treatment that is Phototherapy treatment is most effective & Less Costly treatment for the new born babies. The recovery rate is fast as compare to conventional methods. This treatment is easy and can be used to all age group patients also & Doctors & Nurses can Monitor the Patients Data through Internet on laptop, Smart Mobiles using IoT & Wi Fi Module.

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