**IOT SMART**

**INFANT**

**INCUBATOR**

**DONE BY,**

**V V R S SRIVIDYA**

**JUBIN DAS**

**INTRODUCTION**

Incubator is an enclosed apparatus whose internal environmental is isolated from ambient environment. This is to create favourable environment for the specimen under care.

**PURPOSE**

Incubators are used in hospitals to take care of prematurely born infants. It is a device used to grow and maintain microbiological cultures or cell cultures. The **incubator** maintains optimal temperature, humidity and other conditions such as the CO2 and oxygen content of the atmosphere inside. Once both parameters are set it automatically controls the heating element (bulb) and vaporizer (humidifier) to meet the set point.

**THEORY**

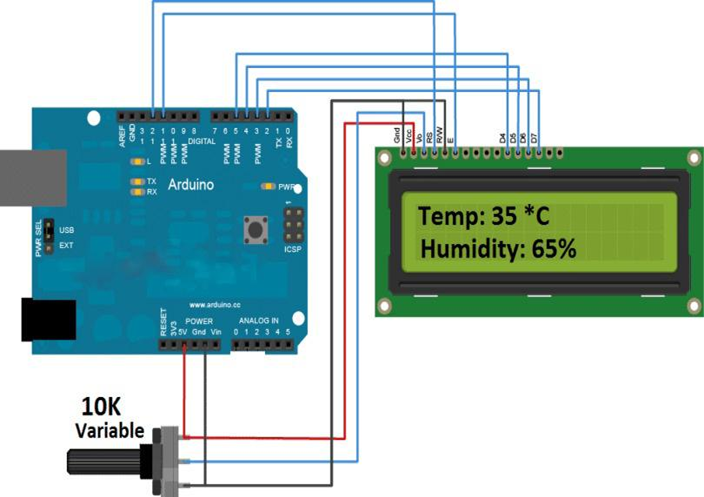
**1  Existing problem**

Infants are born premature so they develop various diseases and conditions while they grow up or may even cause death as soon as they are born.

**2  Proposed solution**

Use of smart infant incubators to regulate temperature and humidity to help the premature infants to become more mature and to grow.

**BLOCK DIAGRAM**



**HARDWARE & SOFTWARE**

Hardware components used :

1.Arduino

2.Temperature sensor

3.Humidity sensor

4.Connecting wires.

Softwares used :

1.IBM cloud 5.Tinker cad

2.IBM IOT platform 6.Python IDLE

3.IBM Watson 7.MIT app inventor

4.node-RED

**RESULT**

Smart infant incubator using Arduino and iot was created and was used for treating premature infants.

**PROS:**

- Many Infants can be helped at the same time in a short while.   
- Incubation cannot spread virus and diseases to the infants.

**CONS:**  
- It requires a lot of skills in order to manage and maintain an incubator.  
- More power consumption which may be a problem in rural areas.

**APPLICATIONS**

-Incubators can likewise be utilized to keep up the way of life of living beings to be utilized later.

-Explicit incubators are utilized for the proliferation of microbial states and ensuing assurance of biochemical oxygen request.

-These are likewise utilized for rearing of creepy crawlies and bring forth of eggs in zoology.

**CONCLUSION**

Smart infant incubator using Arduino and iot is developed to monitor the temperature and humidity values of the infant accordingly maintaining them. This device helped in developing premature babies.

**10 FUTURE SCOPE**

With more High-end hardware and software, the smart infant incubator can be customized and can be upgraded and improved for more efficiency and success rate.

**PROGRAMS:**

**DHT Humidity and Temperature:**

#include <dht.h>

#define dht\_apin A0

dht DHT;

void setup(){

Serial.begin(9600);

delay(500);

Serial.println("DHT11 Humidity & temperature Sensor\n\n");

delay(1000);

}

void loop(){

DHT.read11(dht\_apin);

Serial.print("Current humidity = ");

Serial.print(DHT.humidity);

Serial.print("% ");

Serial.print("temperature = ");

Serial.print(DHT.temperature);

Serial.println("C ");

delay(5000);

}

**Buzzer alarm:**

// Declaring Pins

const int buzzerPin = 5;

const int ledPin = 6;

const int motionPin = 7;

const int buttonPin = 12;

// Setting Buzzer mode to False

boolean buzzer\_mode = false;

// For LED

int ledState = LOW;

long previousMillis = 0;

long interval = 100; // Interval at which LED blinks

void setup()

{

//The Following are our output

pinMode(ledPin,OUTPUT);

pinMode(buzzerPin,OUTPUT);

//Button is our Input

pinMode(buttonPin, INPUT);

// Wait before starting the alarm

delay(5000);

}

void loop()

{

// To chech whether the motion is detected or not

if (digitalRead(motionPin)) {

buzzer\_mode = true;

}

// If alarm mode is on,blink our LED

if (buzzer\_mode){

unsigned long currentMillis = millis();

if(currentMillis - previousMillis > interval) {

previousMillis = currentMillis;

if (ledState == LOW)

ledState = HIGH;

else

ledState = LOW;

// Switch the LED

digitalWrite(ledPin, ledState);

}

tone(buzzerPin,1000);

}

// If alarm is off

if (buzzer\_mode == false) {

// No tone & LED off

noTone(buzzerPin);

digitalWrite(ledPin, LOW);

}

// If our button is pressed Switch off ringing and Setup

int button\_state = digitalRead(buttonPin);

if (button\_state) {buzzer\_mode = false;}

}

**Connecting NodeMCU to WIFI:**

|  |
| --- |
|  |
|  | #include<ESP8266Wifi.h>  #include <PubSubClient.h> |
|  | #include <ArduinoJson.h> |
|  |  |
|  |  |
|  | const char\* ssid = "<yourWIFIssid>"; |
|  | const char\* password = "<yourWIFIpassword>"; |
|  |  |
|  | #define ORG "xyz1kg" |
|  | #define DEVICE\_TYPE "<Arduino" |
|  | #define DEVICE\_ID "<ard123" |
|  | #define TOKEN "12345678" |
|  |  |
|  |  |
|  | char server[] = ORG ".messaging.internetofthings.ibmcloud.com"; |
|  | char authMethod[] = "use-token-auth"; |
|  | char token[] = TOKEN; |
|  | char clientId[] = "d:" ORG ":" DEVICE\_TYPE ":" DEVICE\_ID; |
|  |  |
|  | const char eventTopic[] = "iot-2/evt/status/fmt/json"; |
|  | const char cmdTopic[] = "iot-2/cmd/led/fmt/json"; |
|  |  |
|  |  |
|  |  |
|  | WiFiClient wifiClient; |
|  | void callback(char\* topic, byte\* payload, unsigned int payloadLength) { |
|  | Serial.print("Message arrived ["); |
|  | Serial.print(topic); |
|  | Serial.print("] "); |
|  | for (int i = 0; i < payloadLength; i++) { |
|  | Serial.print((char)payload[i]); |
|  | } |
|  | Serial.println(); |
|  |  |
|  | // Switch on the LED if an 1 was received as first character |
|  | if (payload[0] == '1') { |
|  | digitalWrite(BUILTIN\_LED, LOW); // Turn the LED on (Note that LOW is the voltage level |
|  | // but actually the LED is on; this is because |
|  | // it is acive low on the ESP-01) |
|  | } else { |
|  | digitalWrite(BUILTIN\_LED, HIGH); // Turn the LED off by making the voltage HIGH |
|  | } |
|  |  |
|  | } |
|  | PubSubClient client(server, 1883, callback, wifiClient); |
|  |  |
|  | int publishInterval = 5000; // 5 seconds//Send adc every 5sc |
|  | long lastPublishMillis; |
|  |  |
|  | void setup() { |
|  | Serial.begin(9600); Serial.println(); |
|  | pinMode(LED\_BUILTIN, OUTPUT); |
|  | wifiConnect(); |
|  | mqttConnect(); |
|  | } |
|  |  |
|  | void loop() { |
|  | if (millis() - lastPublishMillis > publishInterval) { |
|  | publishData(); |
|  | lastPublishMillis = millis(); |
|  | } |
|  |  |
|  | if (!client.loop()) { |
|  | mqttConnect(); |
|  | } |
|  | } |
|  |  |
|  | void wifiConnect() { |
|  | Serial.print("Connecting to "); Serial.print(ssid); |
|  | WiFi.begin(ssid, password); |
|  | while (WiFi.status() != WL\_CONNECTED) { |
|  | delay(500); |
|  | Serial.print("."); |
|  | } |
|  | Serial.print("nWiFi connected, IP address: "); Serial.println(WiFi.localIP()); |
|  |  |
|  | } |
|  |  |
|  | void mqttConnect() { |
|  | if (!!!client.connected()) { |
|  | Serial.print("Reconnecting MQTT client to "); Serial.println(server); |
|  | while (!!!client.connect(clientId, authMethod, token)) { |
|  | Serial.print("."); |
|  | delay(500); |
|  | } |
|  | if (client.subscribe(cmdTopic)) { |
|  | Serial.println("subscribe to responses OK"); |
|  | } else { |
|  | Serial.println("subscribe to responses FAILED"); |
|  | } |
|  | Serial.println(); |
|  | } |
|  | } |
|  |  |
|  |  |
|  | void publishData() { |
|  | // read the input on analog pin 0: |
|  | int sensorValue = analogRead(A0); |
|  |  |
|  | String payload = "{\"d\":{\"adc\":"; |
|  | payload += String(sensorValue, DEC); |
|  | payload += "}}"; |
|  |  |
|  | Serial.print("Sending payload: "); Serial.println(payload); |
|  |  |
|  | if (client.publish(eventTopic, (char\*) payload.c\_str())) { |
|  | Serial.println("Publish OK"); |
|  | } else { |
|  | Serial.println("Publish FAILED"); |
|  | } |
|  | } |

**For Publishing the data using MQTT:**

int Publish(char\* payload, int payload\_size) {  
  int rc = -1;  
  MQTTClient client = {0};  
  MQTTClient\_connectOptions conn\_opts = MQTTClient\_connectOptions\_initializer;  
  MQTTClient\_message pubmsg = MQTTClient\_message\_initializer;  
  MQTTClient\_deliveryToken token = {0};  
  
  MQTTClient\_create(&client, opts.address, opts.clientid,  
                    MQTTCLIENT\_PERSISTENCE\_NONE, NULL);  
  conn\_opts.keepAliveInterval = 60;  
  conn\_opts.cleansession = 1;  
  conn\_opts.username = k\_username;  
  conn\_opts.password = CreateJwt(opts.keypath, opts.projectid, opts.algorithm);  
  MQTTClient\_SSLOptions sslopts = MQTTClient\_SSLOptions\_initializer;  
  
  sslopts.trustStore = opts.rootpath;  
  sslopts.privateKey = opts.keypath;  
  conn\_opts.ssl = &sslopts;  
  
  unsigned long retry\_interval\_ms = kInitialConnectIntervalMillis;  
  unsigned long total\_retry\_time\_ms = 0;  
  while ((rc = MQTTClient\_connect(client, &conn\_opts)) != MQTTCLIENT\_SUCCESS) {  
    if (rc == 3) {  // connection refused: server unavailable  
      usleep(retry\_interval\_ms \* 1000);  
      total\_retry\_time\_ms += retry\_interval\_ms;  
      if (total\_retry\_time\_ms >= kMaxConnectRetryTimeElapsedMillis) {  
        printf("Failed to connect, maximum retry time exceeded.");  
        exit(EXIT\_FAILURE);  
      }  
      retry\_interval\_ms \*= kIntervalMultiplier;  
      if (retry\_interval\_ms > kMaxConnectIntervalMillis) {  
        retry\_interval\_ms = kMaxConnectIntervalMillis;  
      }  
    } else {  
      printf("Failed to connect, return code %d\n", rc);  
      exit(EXIT\_FAILURE);  
    }  
  }  
  
  pubmsg.payload = payload;  
  pubmsg.payloadlen = payload\_size;  
  pubmsg.qos = kQos;  
  pubmsg.retained = 0;  
  MQTTClient\_publishMessage(client, opts.topic, &pubmsg, &token);  
  printf(  
      "Waiting for up to %lu seconds for publication of %s\n"  
      "on topic %s for client with ClientID: %s\n",  
      (kTimeout / 1000), opts.payload, opts.topic, opts.clientid);  
  rc = MQTTClient\_waitForCompletion(client, token, kTimeout);  
  printf("Message with delivery token %d delivered\n", token);  
  MQTTClient\_disconnect(client, 10000);  
  MQTTClient\_destroy(&client);  
  
  return rc;  
}

**OUTPUTS:**

