

# Design and Implementation of Alert System for Monitoring the Ambient Temperature Using Cloud Computing In Hospital Regions

K K Megavarthini, S Vignesh, S Paul Joshua, A P Gokulraj, V Indirakumar

**Abstract:** *The incubators in most of all the hospitals require a device for monitoring the ambient temperature in order to ensure the prevention of illness or issues related to growth in new babies. The concept of temperature monitoring is said to affect the environmental condition of the incubator based on several external factors. The technique of cloud computing through Ubidots software can be used to analyze the variation in temperature of the incubator. This also shows that the alert system can be incorporated for sensing the rise in temperature and indicating the same to hospital users. The alert unit which has been developed and installed in the hospitals are provided with an option to become beneficial for most of the patients.*

**Keywords:** *temperature monitoring; alert system; incubators; environmental condition; cloud computing; hospital zones*

## I. INTRODUCTION

The use of incubators in most of the hospitals require temperature measuring device which plays a vital role for maintaining the temperature of it. The deviation of existing values from that of the accurate values are considered to be essential for detecting and rectifying the same. In order to ensure that the infant has been maintained in a thermo-neutral environmental location, the monitoring of temperature is essential [1]. The problem of illness or issues related to growth in new born babies can be rectified when the incubators are developed with a design to provide an optimal environment. The incubator temperature varies from 36.5°C to 37.2°C. This temperature will be maintained in constant condition throughout the functioning of the system. It can be observed from the values that are plotted using Ubidots software. If the temperature rises above the normal value, the sensor will sense and send an alert to mobile phones or main panel. The temperature ranges of the environment have been controlled using the physiological zone which maintains a temperature thereby without affecting the increase of the baby's metabolism. There is a huge need to monitor and store the data related to temperature in software which can be used for analyzing the temperature.

**Manuscript published on 30 November 2018.**

\*Correspondence Author(s)

**K K Megavarthini**, Department of Mechatronics, Bannari Amman Institute of Technology, Sathyamangalam-638401, Tamil Nadu, India

**S Vignesh** Department of Mechatronics, Bannari Amman Institute of Technology, Sathyamangalam-638401, Tamil Nadu, India

**S Paul Joshua** School of Mechanical Engineering, SASTRA Deemed University, Thanjavur - 613401, Tamil Nadu, India

**A P Gokulraj** Department of Mechatronics, Bannari Amman Institute of Technology, Sathyamangalam-638401, Tamil Nadu, India

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an [open access](https://creativecommons.org/licenses/by-nc-nd/4.0/) article under the CC-BY-NC-ND license <http://creativecommons.org/licenses/by-nc-nd/4.0/>

The Node MCU which is an IoT platform is used as a microcontroller. The other requirements are Arduino, electric battery, breadboard, DHT11 temperature and humidity sensor.

## II. LITERATURE REVIEW

The protection of dust, viral infections, and bacteria plays an important role in establishing the isolated mode of environmental condition which helps in enabling the functioning of incubator. It also helps in controlling the temperature, level of oxygen content, and humidity which helps to maintain the system in acceptable state [2]. When we compare the new born babies which has several growth issues in the body with the normal ones, it is clear that the external conditions may affect the child for which several precautionary measures have to be taken. The hospitals have to create a secured and healthy living place for the patients.

The goal is to ensure the safety of patients as well as medical devices. The effective way of managing several human resources as well as the physical environment of hospital is equally important. The severity which involves with the medical devices are mainly due to the potential hazards attached with poor performance of such devices [3]. This happens mainly due to the sudden increase in the number of medical devices which are widely used in several hospitals. The daily neonatal care mainly depends on the measurement of temperature. The optimal results can be obtained thereby detecting the accurate values and comparing them with existing results. The temperature of incubator may not vary from its average incubator temperature above 0.5°C at the time of steady state condition. This can happen in a controlled temperature zone ranging between 32°C to 36°C for a time period of one hour. The user has to ensure the frequency of oscillations from the minimum to maximum state [4].

The average temperature of each of the points cannot be altered from the average incubator temperature. It always tend to exist between the controlled temperature regions. The standard thermometer is always found to be accurate with the allowable range of  $\pm 0.05^\circ\text{C}$ . This temperature will tend to remain constant. It can be observed that the values are obtained with the help of Ubidots software. If the temperature rises above the normal value of the sensor,

it will sense and send an alert to the mobile phones [5]. The proposed system can exhibit physiological zone which is a narrow range of environmental temperature values in which the infant is kept at a normal body temperature without increasing his or her metabolism. This helps the system to monitor the temperature and store the data. This ensures the measurement of ambient temperature condition in hospital zones.

### III. METHODOLOGY

The proposed system has been designed and implemented with the help of Ubidots software. The program code [6] which has been utilized for execution is provided below. The incubator temperature varies from 36.5°C to 37.2°C. The temperature is said to be maintained at constant level. The plotted values can be obtained using Ubidots software. If the temperature is said to rise above the normal value of sensor, it will sense and indicate the operator through several alarms [7]. The proposed system is said to have a cloud storage interface which works based on the Ubidots software. It also uses Node MCU as the microcontroller unit in the proposed system. The plots obtained using Ubidots software is shown in Figure 1.



Figure 1 Plots obtained in Ubidots software

#### Coding:

```
#include "UbidotsESP8266.h" #include <OneWire.h>
#include <DallasTemperature.h>
#define TOKEN "BBFF-LrdFAW6veJFQJW0TH93aCiOQoQGzgf" // Your Ubidots
TOKEN
#define WIFINAME "GOKUL" //Your SSID
#define WIFIPASS "PASSWORD" // Your Wifi Pass
#define MQTTCLIENTNAME "asdfrewq" // Your MQTT
Client Name, it must be unique so we recommend to choose
a random ASCII name
#define Pin D3
float temp;
OneWire ourWire(Pin); Dall
a sTemperature sensors(&ourWire);
Ubidots client(TOKEN, MQTTCLIENTNAME);
void callback(char* topic, byte* payload, unsigned int
length) { Serial.print("Message arrived [");
Serial.print(topic); Serial.print("] ");
```

```
for (int i=0;i<length;i++) { Serial.print((char)payload[i]);
}
Serial.println();
}
void setup() {
// put your setup code here, to run once:
Serial.begin(115200); client.wifiConnection(WIFINAME,
WIFIPASS); sensors.begin();
client.begin(callback);
}
void loop() {
// put your main code here, to run repeatedly:
if(!client.connected()){
client.reconnect();
}
int a =digitalRead(D3);
client.add("temperature", a); //Insert your variable Labels
and the value to be sent delay(1000);
client.ubidotsPublish("control");
client.loop();
}
```

### IV.RESULTS AND DISCUSSION

The real time functioning of proposed system can be ensured using the temperature of each incubator. The plotted values are mapped to each item in the Ubidots software in which the temperature ranges within the controlled level. The Ubidots software uses a cloud storage system for storing the values of temperature and retrieving them for several analysis. The real time monitoring of system has been shown in Figure 2. The proposed system tends to improve the efficiency and convenience of the way of alerting to user. It can be accessed from any of the places by the patient.

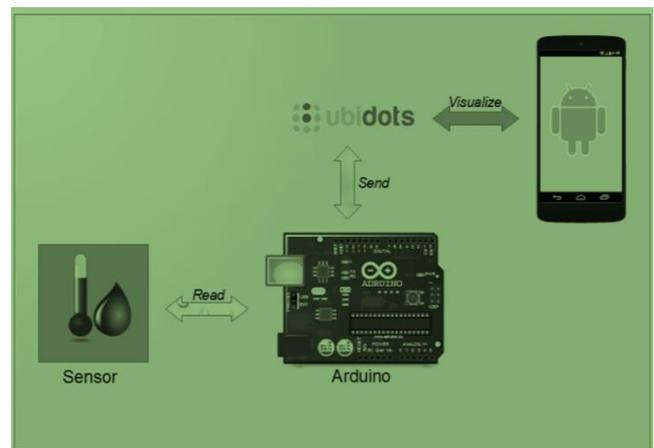


Figure 2 Proposed system through Ubidots software [6]

### V.CONCLUSIONS

The ambient temperature of the system has been monitored and controlled with the help of cloud computing. It has been demonstrated with an intention to maintain a constant range of temperature in the incubators.

The design and development of alert unit for installing in the hospital zones is a successful attempt which will be very much beneficial for the patients. The other areas to be focused for implementing the same can be automobile vehicles, food stalls, boilers, etc. The future scope of proposed system lies in interfacing an oxygen monitoring unit to the existing system.

## REFERENCES

1. Radu-Corneliu Marin, Radu-Ioan Ciobanu, Ciprian Dobre, "Improving Opportunistic Networks by Leveraging Device-to-Device Communication", *Communications Magazine IEEE*, vol. 55, no. 11, pp. 86-91, 2017.
2. M. R. C. Trusca, S. Albert and M. L. Soran, "The benefits of data center temperature monitoring," 2015 Conference Grid, Cloud & High Performance Computing in Science (ROLCG), Cluj-Napoca, 2015, pp. 1-3.
3. Daniel Rosner, Razvan Tataroiu, Laura Gheorghe, Razvan Tilimpea, "UNCHAIN - Ubiquitous Wireless Network Communication Architecture for Ambient Intelligence and Health Scenarios", *Secure Internet of Things (SIoT) 2014 International Workshop on*, pp. 44-51, 2014.
4. Evangelos K. Markakis, Asimakis Lykourgiotis, Ilias Politis, Anastasios Dagiuklas, Yacine Rebahi, Evangelos Pallis, "EMYNOS: Next Generation Emergency Communication", *Communications Magazine IEEE*, vol. 55, no. 1, pp. 139-145, 2017.
5. C. Cesar Medeiros Davi, D. Silva Silveira and F. Buarque de Lima Neto, "A Framework Using Computational Intelligence Techniques for Decision Support Systems in Medicine," in *IEEE Latin America Transactions*, vol. 12, no. 2, pp. 205-211, March 2014.
6. Ubidots : IoT platform - Internet of Things, <http://help.ubidots.com/iot-projects-tutorials>
7. Lisha Yu, Wai Man Chan, Yang Zhao, Kwok-Leung Tsui, "Personalized Health Monitoring System of Elderly Wellness at the Community Level in Hong Kong", *Access IEEE*, vol. 6, pp. 35558-35567, 2018.