Asian Journal of Science and Applied Technology
ISSN: 2249-0698 (P) Vol.7 No.1, 2018, pp.36-43
© The Research Publication, www.trp.org.in
DOI: https://doi.org/10.51983/ajsat-2018.7.1.1020

# Effective Monitoring of Temperature and Humidity in Real-Time Wireless Sensor Method of Processor and System Architecture

**P. Senthil**
Associate Professor in MCA Computer Science, Kurinji College of Arts and Science, Tiruchirappalli, Tamil Nadu, India
E-mail: senthilkanapathy@gmail.com
(Received 4 April 2018; Revised 25 April 2018; Accepted 13 May 2018; Available online 20 May 2018)

**Abstract - Today, the place of the same word, "Analog Records" is in place for the work of WSN like it The system immune system for landing damage caused by analogue systems Storage in Memory. So it is that we have an excellent law completely automated Possible Accuracy More, such a comparison should be cheap as well as qualified transport. In this Paper introduces wireless sensor (WS) facts using communication software DHT11, Arduino Education At Bett 2017, SIM900A GSM module, sales tool and liquid crystal display (LCD). Heating system in experimental settings includes DHT11 transmission and use Ardino and SIM 900 GSM shield, Arduino, GSM shield, still in use displays a heating system for the LCD screen and thermal sensitive.**
**Keywords: LCD, DHT11, Transmission, Arduino, SIM 900 GSM shield. Arduino, GSM shield**

## I. INTRODUCTION

Wireless sensor network [1] temperature, humidity, voltage, current, etc., can be used in wireless sensor networks to calculate data from different sensors. Remotely Cooperative network locations and data transfer Therefore, wireless sensor networks can be used the remote location to control the electrical data [2], [3]. Continuous online monitoring of physical quantities is a co-owner of remote control stations coordinating the uninterrupted work of the process of plants, and household utilities, also [4]. An attempt to keep these conditions Wireless sensor networks [6], [7], which are transmitted to all data measured by project transfer monitoring data Temperature Controller and Humidity Sensor (DHT 11), LCD, Sim 900 G SM module, which allows .

Developed by a home that runs the Arduino IDE software and the Arduino Uno board [8], which throws [9]. This method is a wireless system that can be independently monitored As well as the temperature or the control of the physical or environmental conditions such as moisture, and control stations can stream data is [10-14]. This is Wireless sensor networking is a two-way system that includes various units in the system that are shown below as a thorough and accurate analysis of the rhythm of the work. As this system is equipped with a high sensitivity sensor, low latency networks and control accuracy.

1. Components, this system are a very reliable application [14-15].
2. Sensing unit – Temperature & Humidity Sensor (DHT11).
3. Processing unit – A Microcontroller (ATMEGA 328P).
4. Communication unit – GSM shield (Transmitter) and Mobile device (Receiver) [16].
5. Power unit – Battery.

## II. PROBLEM DEFINITION & WORK PLAN

This work is included in the respective 20% to 90% different degrees and 50-degree wireless sensor networks and areas of Humidity temperature parameters through a system that includes GTRs. This system is an open source software platform based on the work platform Arduino IDE. So you realize that Arduino IDE allows coding and other languages Matlab 2016b system C, Ambles make you dump it into the code and make your Microcontroller alive project.

## III. METHODOLOGY

The following method was used in my work:
First, they became Humidity have and temperature sensor (Dell) ware area, bay monitoring. The sensor interface has been implemented by the UN's Arduino Development Board. In the Arduino system, programming sensor will digitize analog output. Digital temperature and humidity values will be displayed in the LCD after the digital information GSM module[17], which swings the fake serial peripheral communication with Arduino in the interest adoption. GSM module will transmit data via SMS to Arduino mobile devices. Additionally, the temperature Arduino the programming temperature threshold, the funds are used automatically (5 V DC motor caretaker as Fan here) cold Hey has taken B is used to maintain temperature and a mobile precaution of battery devices Is determined by the SMS-device is similar to the LCD device shown. Powered by Arduino Shield Hey GSM and Ten Adders / USB Cord. All other components are Arduino (+ 5V).

### *A. Flow Chart*

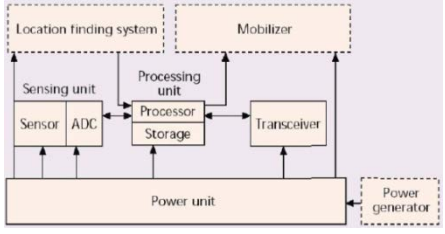


Fig.1 Arduino Shield Block diagram

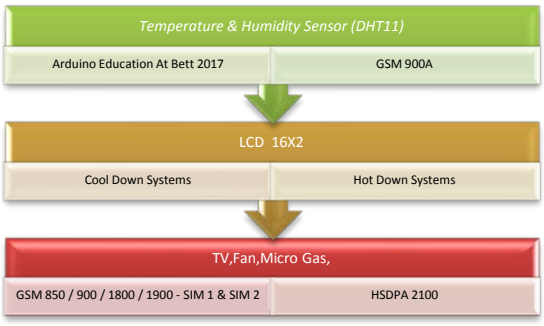


Fig. 2 Block diagram of the system

*B. Atmega 328P*

```
PORT = 'COM4';  % Change as necessary
BAUD = 9600;
BITS = 8;       % Number of data bits
AVR = serial(PORT, 'BaudRate', BAUD, 'DataBits', BITS);
fopen(AVR);
pause(1);
fwrite(AVR, 3, 'async');
while AVR.BytesAvailable == 0
end
% Store AVR response in variable 'response'
response = fread(AVR, AVR.BytesAvailable, 'uint8');
% Display received data on command line
disp('AVR:');
disp(response);
fclose(AVR);
delete(AVR);
clear AVR;
```

*C. TIMER_IT:*

```
1.  save status register and temp =heap;
2.  push temp=0;
3.  in temp, DH11;
4.  push temp;
5.  Prog=<...IT-handling...>;
6.  Con=restore temp and then status;
7.  pop (temp);
8.  out DH11=temp;
9.  pop temp;
10. reti  =return;
11. ldi temp>0b00001111;
12. DTH1=10; FOC=0;
13. NULL=0,1 ;
14. WGM=10 (clear timer on compare match)
15. 00 = COM=00 (output disable)
16. 111             + CS0=111 (CLK/1024)
17. out =WNS;
18. TCCR0+temp =Timer 0 +TCCR0 register;
19. Binary code=compare register;
20. ldi;
21. temp,108   ; 11059200Hz/1024 = 108*100
22. out = GSM900A
23. OCR0,temp ; Timer 0 OCR0 register
24. Timer 0 IT enabled, others disabled
25. ldi=Dth11
26. temp,0b00000010
27. Binary code< 000000= Timer2 +1> disabled
28. Binary code= 1; OCIE0=1 - match
29. Opcode=0 ; TOIE0=0 – overflow ;
30. out WNS;
31. TIMSK,temp ; Timer IT Mask register
32. sei ( global IT)+ enabled=0;
33. Writing output data (e.g. LCDs):
34. ldi temp, 0xff =8 bit output
35. out DDRC= temp;
36. out PORTC+ temp= turn on all LCDs
37. Reading Data =0;
38. ldi temp=0xFF;
39. sts( PORTG)+ temp = non tri-state
40. ldi temp + 0x00= input code;
41. sts DDRG =temp;
42. lds temp, PING = read PIN End
```

*D. DHT C Code*

```
#include “DHT.h"
#include<SoftwareSerial.h>
#include<LiquidCrystal.h>

#define DHTPIN 2
#define DHTTYPE DHT11
#define cool 13

SoftwareSerial mySerial(9,10);
LiquidCrystal lcd(3,4,5,6,7,8);

DHT dht(DHTPIN,DHTTYPE);
float t,h;

void setup()
{
      mySerial.begin(9600);
      Serial.begin(9600);
      delay(1000);
      dht.begin();
      WelcomeDisplay();
      gsmInit();
}

void loop()
{
      displayLCD();
      SendText();
}
void tempstatus()
{
      if(t>35)
      {
            digitalWrite(cool,HIGH);
            lcd.setCursor(1,0);
            lcd.print("Temperature");
```

```
            lcd.setCursor(3,1);
            lcd.print("CRITICAL");
            lcd.clear();
            lcd.print("Initializing");
            lcd.setCursor(2,1);
            lcd.print("COOL DOWN");
            mySerial.println("AT+CMGF=1\r");
            delay(1000);
            mySerial.println("AT+CMGS=\"+917405306747
            \"\r");
            delay(1000);
            mySerial.println(" ");
            mySerial.println("***Temperature
            CRITICAL***");
            mySerial.println("COOL DOWN Process
            Activated");
            delay(1000);
            mySerial.println((char)26);
            lcd.clear();
      }
      else
      {
            digitalWrite(cool,LOW);
      }
}
void SendText()
{
      lcd.clear();
      lcd.print("Delivering SMS..");
      mySerial.println("AT+CMGF=1\r");
      delay(1000);
      mySerial.println("AT+CMGS=\"+917405306747\"\r");
      delay(1000);
      mySerial.println("Temperature & Humidity Stats.");
      mySerial.println("Temperature");
      mySerial.print(t);
      mySerial.println(" C");
      mySerial.println("Humidity");
      mySerial.print(h);
      mySerial.println(" %");
      mySerial.println("***Temperature Stable***");
      delay(1000);
      mySerial.println((char)26);
      //mySerial.flush();
      lcd.clear();
      for(int i=0;i<1800;i++)
      {
            delay(1000);      //35 mins delay
            tempstatus();
            displayLCD();
      }
}
void WelcomeDisplay()
{
      lcd.begin(16, 2);
      lcd.setCursor(0,0);
      lcd.print("TEMP. & HUMIDITY");
      lcd.setCursor(1,1);
      lcd.print("MONITORING SYS.");
      delay(2000);
      lcd.clear();
      lcd.setCursor(0,0);
      lcd.print("By: JAY SIPANI..");
      lcd.setCursor(4,1);
      lcd.print("(15EC104)");
      delay(2000);
      lcd.clear();
}
void displayLCD()
{
      lcd.setCursor(0,1);
      h = dht.readHumidity();
      t = dht.readTemperature();
      if (isnan(h) || isnan(t))
      {
            lcd.print("ERROR");
            return;
      }
      lcd.setCursor(0,0);

      lcd.print("Temp.:");
      lcd.setCursor(7,0);

      lcd.print(t);
      lcd.setCursor(12,0);
      lcd.write(B11011111);
      lcd.print("C");
      lcd.setCursor(0,1);
      lcd.print("Humidity:");

      lcd.setCursor(10,1);
      lcd.print(h);
      lcd.setCursor(15,1);
      lcd.print("%");
}

void gsmInit()

{
      lcd.clear();
      lcd.print("Sensing SIM900A");
      lcd.setCursor(2,1);
      lcd.print("GSM Module");

      boolean at_flag=1;
      while(at_flag)
      {
        mySerial.println("AT");
        while(mySerial.available()>0)

        {
            if(mySerial.find("OK"))
            at_flag=0;
        }

       delay(1000);
      }
```

```
    mySerial.println("ATE0");
    lcd.clear();
    lcd.print("Establishing");
    lcd.setCursor(0,1);
    lcd.print("Network...");
    boolean net_flag=1;

    while(net_flag)
    {
        mySerial.println("AT+CPIN?");
        while(mySerial.available()>0)
        {

            if(mySerial.find("READY"))

                net_flag=0;
                break;
        }
        delay(1000);
    }
}
```

## IV. EXPERIMENTAL SETUP

We have developed an experimental setup using various hardware modules to measure and monitor temperature and humidity parameters in various environments. Let's discuss in brief about the Hardware Modules interfaced in the setup.

### *A. Measurement and Data Analysis*

We have measured the temperature and humidity of various premises and have done analysis of the data acquired from the project. Here are some proof regarding the analysis. The images subjected below are the proof that the system has been setup in an environment and been monitored since the installation. The threshold temperature is set to 35 °C which means that if the DHT11 sensor detects a t emperature greater than 35 °C, then the microcontroller sends the response signal to the Cooling devices connected to it and initializes the process to maintain the temperature below the threshold.

### *B. Temperature and Humidity Sensor*

Figure 2 DHT11 (Digital Humidity and Temperature) sensor senses the temperature and humidity of the surrounding and gives a calibrated digital signal output. The sensor includes a resistive type humidity measurement component along with an NTC temperature measurement component.

It is connected to an 8-bit microcontroller for high performance which offers excellent quality, fast response and anti-interference ability. It has a low power operating range (3V-5V). The component is 3-pin single row package and the major feature of this sensor is that the data for both temperature and humidity is available on a single data pin of the sensor.

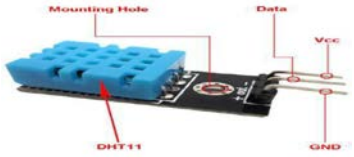


Fig. 3 DHT11 Sensor

TABLE I GENERAL SPECS OF DHT11 SENSOR

| Measurement Range | Humidity Accuracy | Temp Accuracy | Resolution | Package |
|---|---|---|---|---|
| 20-90% RH 0-50 °C | ±5% RH | ±2 °C | 1 | 4 Pin Single Row |

### *C. Arduino UNO Development Board*

Figure 3 Arduino is an open-source prototyping platform. Arduino boards are able to receive inputs and can convert into relevant output. It contains on-board power supply, USB port to communicate with PC, and an ATMEL microcontroller chip. It simplifies the process of creating any control system by providing the standard board that can be programmed and connected to the system without the need to any sophisticated PCB design and implementation. It is inexpensive, open-source and extensible, cross-platform and has a clear IDE.

Fig. 4 Arduino UNO R3

It has figure 4 microcontroller on board ATMEGA328P which is an Atmel 8-bit AVR RISC-based microcontroller.

Fig. 5 ATMEGA 328P AVR Microcontroller

### *D. CPU*

1. 8 bit, 16 MHz
2. 133 RISC instructions
3. Typically 1clk/instruction (except branch)

*E. Memory*

1. 328K Flash (program)
2. 4K EEPROM + 4K internal SRAM (data)
3. 32 register (16 upper special, 3 register pairs)

Reason to choose ARDUINO UNO R3:

a. Simple to use and has on board debugger.
b. Much cheaper than other development boards available in market.
c. Consumes very less power and delivers greater accurate results.
d. It supports variety of sensor modules readily available to be interfaced with it.

*F. SIM900A GSM Shield*

Figure 6 SIM900 is designed with a very powerful single-chip processor integrating AMR926EJ-S core. It is a Quad – band (850/ 900/ 1800/ 1900 MHz) GSM/GPRS module with a size of 24mmx24mmx3mm with SMT type suit for customer application. It has an embedded Powerful TCP/IP protocol stack. It can communicate with microcontrollers via AT commands. This module supports software power on and reset.

Fig. 6 SIM900A GSM Module

Reason to choose SIM900A GSM Shield

1. Supports GPRS.
2. Better specifications than ZigBee, which is also a Wireless Communication Module.
3. Easy to operate using AT commands and can be interfaced easily with any development board**.**

*G. 16x2 Liquid Crystal Display(LCD)*

Figure 7 LCD (Liquid Crystal Display) is used in all the electronics projects to display the status of the process. A 16x2 alphanumeric LCD is most widely used module of LCD nowadays. There are several other types of LCD available in the market also. The LCD are low cost, easily programmable, displays large number of characters and compatible with almost all microprocessor and microcontroller. 16x2 LCD has two horizontal line comprising a space of 16 displaying character. It has two inbuilt registers:

1. Command Register
2. Data Register

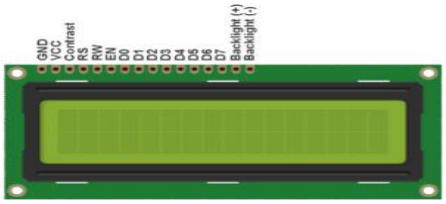


Figure 7 LCD (Liquid Crystal Display

*H. Hardware Setup*

The below figure shows the full hardware setup of the system.

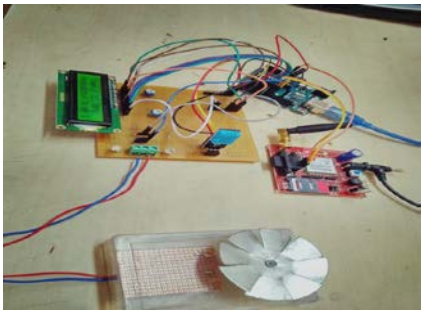

Figure 8 Hardware Setup of System

TABLE II GENERAL SPECS OF SIM900A GSM MODULE

| | |
|---|---|
| Pcb size | 71.4mmx66.0mmx1.6mm |
| Indicator | Pwr, status led, net led |
| Power supply | 12 v |
| Communication Protocol | Uart |
| Rohs | Yes |

The figure 8, as seen above displays every component of the system along with their interfacings. The system is fully operational and functional.

*Case 1: When temperature is below the threshold temperature (35 °C)*

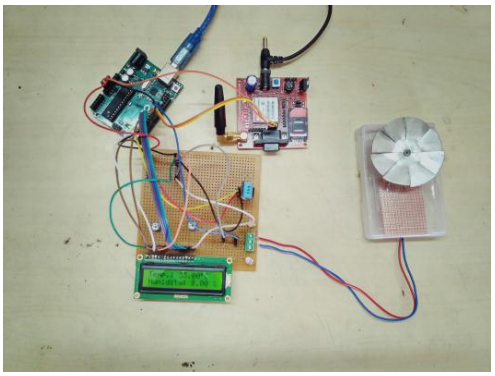

Fig. 9 System in Steady State

When the temperature of the nearby premises temperature is below the threshold, it sends a text message to the mobile device indicating the present Temperature and Humidity Statistics. This way the system is under fully steady condition as there is no need to activate the cooling systems.

The figure 8 system in steady state means the DHT11 sensor is sensing the temperature below the threshold limit and therefore the Cooling System are in OFF state and an acknowledgment message about the temperature and humidity stats is sent to the mobile device during the boot-up of the system.

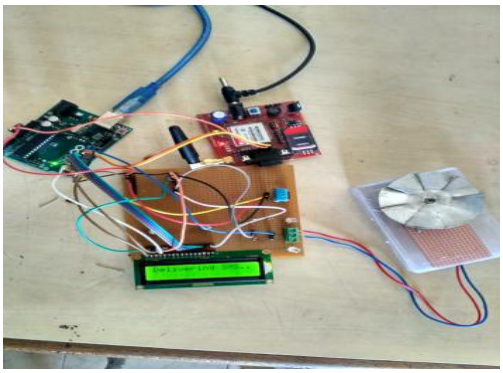

Fig. 10 SMS delivering process of system

*I. Status Register (DH11)*

DH11: Status Register
C: Carry Flag
Z: Zero Flag
N: Negative Flag
V: Two's complement overflow indicator
S: N ⊕ V, For signed tests
H: Half Carry Flag
T: Transfer bit used by BLD (Bit load) and BST (Bit store) instructions
I: Global Interrupt Enable/Disable Flag


Fig. 11 Screenshot of SMS received on Mobile Test

*Case 2: When temperature is beyond the threshold temperature (35 °C)*

Figure 8 shows when the temperature of the premises is increased by means of putting a candle flame away at a distance of about 5 cm from the sensor, an increase in the temperature is marked and this temperature gradually increases with time. At one moment when it crosses the threshold temperature of 35 °C the Arduino sends a response signal to the cooling systems, figure 10 which are initialized to cool the surroundings of the premises and at the same time continuous SMS strings are sent to mobile having a warning message of critical temperature rise.

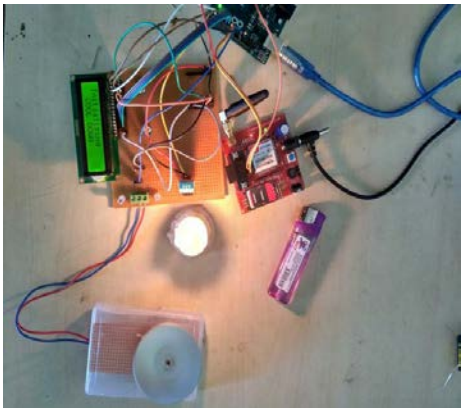

Fig.12 Cool down process Initialized when temperature is raised

## V. EXPERIMENTAL EVALUATION

Figure 11 The text message is sent at a continuous rate with about an interval of 1 second to the mobile until the temperature is reduced back to normal one.

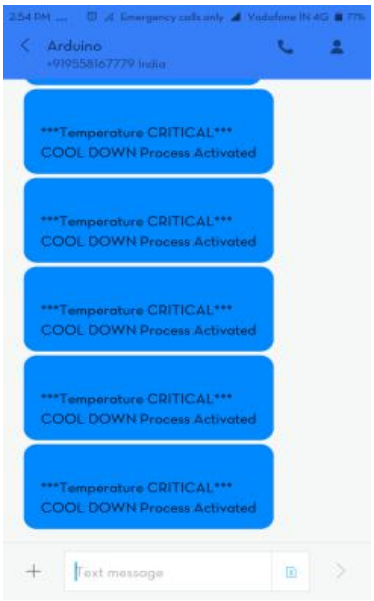


Fig. 13 Screenshot of SMS received during critical rise in temperature

Figure 12 shows the chain of message is stopped when the temperature is brought back to normal by cooling devices and the system is put back again to steady state condition. Hence, the cooling systems are deactivated.

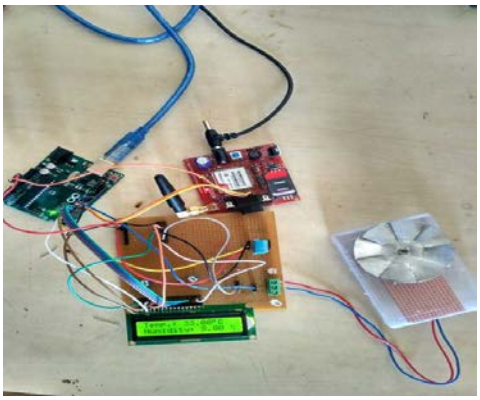

Fig.14 System returned in Steady state

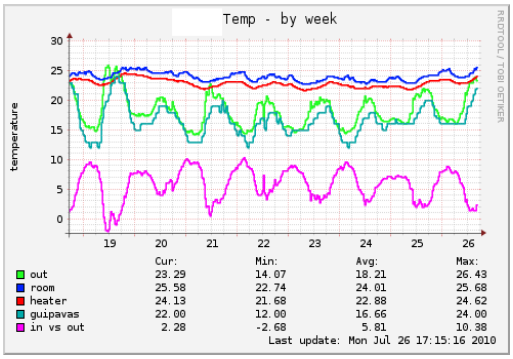


Fig. 15 DHT11 transmission and use Ardino and SIM 900 GSM shield, Arduino, GSM

### *A. Comparative Study*

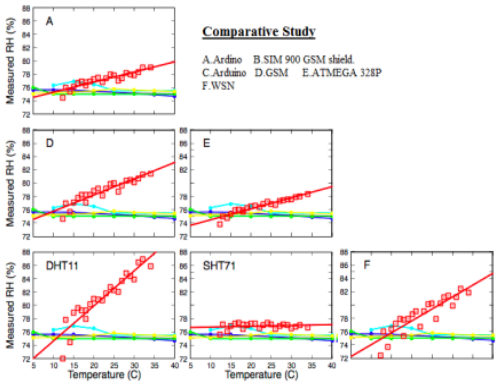


Fig. 16 Comparative study, DHT11 transmission and use Ardino and SIM 900 GSM shield, Arduino, GSM

### *B. Pros Vs. Cons*

*Pros*

1. This system is competent and reliable for real time monitoring of temperature and humidity.
2. As this system is totally digital, there is full arrangement of storage of the data so it can be further used for analysis purpose.
3. As the system is continuously monitoring the environment parameters, the user is updated at every fixed interval of time about the change in the parameters. This makes the user keep a better eye at the premises.

*Cons*

1. This system is developed only for small area.
2. If the mobile device is out of network coverage area, then there are chances of loss of information sent over SMS to the mobile.
3. Though the sensor is nicely calibrated, there are chances of error in the readings as the sensor may get damaged when exposed to higher temperature beyond its limit.

## VI. FUTURE SCOPE

From my present proposed work, it is clear that the system developed by me is working absolutely fine at domestic premises. This system is slightly improved with respect to some previous projects like this taken by another people and a development of some new features is also included under my proposed work.

In future, this system would be upgraded to web-based monitoring system by using the GPRS technique which would ease the user to have access over the system remotely over the Internet. Also, an upgrade for the monitoring of larger area would be done. Additionally, sensors like barometric pressure sensor, gas detector for air quality check, a web interface would be all integrated into a single system which could just not only measure the temperature and humidity parameters but also the other parameters would be analyzed.

## VII. CONCLUSION

This concludes so much the current proposed employment was once a advancement yet that wish grant a convenient approach because super government over fire dampness among real time. This law is succinct to an content and worth tremendous now in contrast in accordance with costs on units old according to metering the environmental factors. From the over whole analysis, such is ensured so the nested wired structures perform be changed by way of the wi-fi sensor networks according to find an right statistics namely nicely as in accordance with keep away from deep breakneck issues.

## REFERENCES

[1] Z. Zhu, T. Liu, G. Li, T. Li and Y. Inoue, “Wearable Sensor Systems for Infants”, *Sensors* (Basel, Switzerland), Vol. 15, No. 2, pp. 3721–3749, 2015, [Online]. Available: http://doi.org/10.3390/s150203721

[2] Patel, H. Riki, Arpan Desai and Trushit Upadhyaya, “A Discussion on Electrically Small Antenna Property”, *Microwave and Optical Technology Letters*, Vol. 57, Issue 10, pp. 2386-2388, 2015.

[3] T. K. Upadhyaya, S. P. Kosta, R. Jyoti and M. Palandöken, “Novel stacked μ-negative material-loaded antenna for satellite applications”,

*International Journal of Microwave and Wireless Technologies*, Vol. 8, No. 2, pp. 229-235, 2016.

[4] Ellis and M. Trevor, "Investigation of Outbreaks of Highly Pathogenic H5N1 Avian Influenza in Waterfowl and Wild Birds in Hong Kong in late 2002", *Avian Pathology,* Vol. 33, Issue 5, pp. 492-505, 2004.

[5] S. Geetha and S. Gouthami, "Internet of Things Enabled Real Time Water Quality Monitoring System", *Smart Water International Journal for Smart*, ICT for Water20172:1, [Online]. Available: https://doi.org/10.1186/s40713-017-0005-y

[6] Y. Zhang, W. Yang, D. Han and Y. I. Kim, "An Integrated Environment Monitoring System for Underground Coal Mines—Wireless Sensor Network Subsystem with Multi-Parameter Monitoring", *Sensors* (Basel, Switzerland), Vol. 14, No. 7, pp. 13149–13170, 2014, [Online]. Available: http://doi.org/10.3390/s140713149

[7] K. Devarakonda, K. P. Nguyen and A.V. Kravitz, "Behav Res", Vol. 48, pp. 503, 2016, [Online]. Available: https://doi.org/10.3758/s13428-015-0603-2

[8] W. W. Gay, "DHT11 Sensor. In: Experimenting with Raspberry P", *Apress,* Berkeley, CA, 2014, [Online]. Available: https://doi.org/10. 1007/978-1-4842-0769-7_1

[9] D. Tripathy and J. L. Raheja, "Design and Implementation of Brain Computer Interface Based Robot Motion Control", in: S. Satapathy, B. Biswal, S. Udgata and J. Mandal (eds) *Proc. of the 3rd Int. Conf. on Frontiers of Intelligent Computing: Theory and Applications (FICTA)* 2014, Advances in Intelligent Systems and Computing, *Springer*, Cham, Vol. 328, 2015, [Online]. Available: https://doi.org/10.1007/978-3-319-12012-6_32

[10] E. Nascimento, J. López and R. Dahab, "Efficient and Secure Elliptic Curve Cryptography for 8-bit AVR Microcontrollers", in: R. Chakraborty, P. Schwabe and J. Solworth (eds) Security, Privacy, and Applied Cryptography Engineering. Lecture Notes in Computer Science, *Springer*, Cham, Vol. 9354, 2015, [Online]. Available: https://doi.org/10.1007/978-3-319-24126-5_17

[11] H. S. Akbar, A. I. Siddiq and M. W. Aziz, "Microcontroller Based Dual Axis Sun Tracking System for Maximum Solar Energy Generation", *American Journal of Energy Research*, Vol. 5, No. 1, 23-27, 2017, DOI: 10.12691/ajer-5-1-3

[12] Susan Makrouhee Haynes, "Using the Atmel AVR (arduino microcontroller) as the Foundation of Beginning Computer Organization Course", in *Proc. of the 44th ACM Technical Symposium on Computer Science Education (SIGCSE '13)*, ACM, New York, NY, USA, pp. 737-737, 2013, DOI: http://dx.doi.org/10.1145 /2445196.2445435

[13] M. K. Madhan Kumar, "Automated Brain Monitoring Using GSM Module", in: A. Chakrabarti and R. Prakash (eds) ICoRD'13, Lecture Notes in Mechanical Engineering, *Springer,* India, 2013, [Online]. Available: https://doi.org/10.1007/978-81-322-1050-4_87

[14] A. K. Pardeshi, H. Pahuja and B. Singh, "Development of Real Time Helmet based Authentication with Smart Dashboard for Two Wheelers", in: J. Corchado Rodriguez, S. Mitra, S. Thampi and El-Alfy ES. (eds) Intelligent Systems Technologies and Applications 2016. ISTA 2016, Advances in Intelligent Systems and Computing, *Springer,* Cham, Vol. 530, 2016, [Online]. Available: https://doi.org/10.1007/978-3-319-47952-1_79

[15] Pramanik, Rishikesh, V. Nagar, S. Dwivedi and B. Choudhury, "GSM based Smart home and digital notice board", *Int. Conf. on Computational Techniques in Information and Communication Technologies (ICCTICT)*, New Delhi, 2016, pp. 41-46. doi:10.1109/ICCTICT.2016.7514549, [Online]. Available: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp= &arnumber=7514549&isnumber=7514538

[16] Quan Yu, "Space Information Networks", *1st Int. Conf. on SINC 2016,* Kunming, China, August 24-25, 2016. DOI https://doi.org/10.1007/978-981-10-4403-8.

[17] M. Ivanovich, M. Zukerman, P. Fitzpatrick and M. Gitlits, "Performance between Circuit Allocation Schemes for Half- and Full-Rate Connections in GSM", in *IEEE Transactions on Vehicular Technology,* Vol. 47, No. 3, pp. 790-797, Aug 1998, DOI:10.1109/25.704834