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Advanced Home Automatiom and Security System (Has) With Energy Management System (Hems) Using Iot Technology

P. Ashok Kumar
Research Scholar, Department Of ECE
Sri Satya Sai University of Technology and Medical Sciences, Sehore, Bhopal, MP (India)

Abstract– *The Internet of Things (IoTs) can be described as connecting everyday objects like smart-phones, Internet TVs, sensors and actuators to the Internet where the devices are intelligently linked together enabling new forms of communication between things and people, and between things themselves.In this project, we design and development of a smart monitoring and controlling system for household electrical appliances in real time. The system principally monitors electrical parameters of household appliances such as voltage and current and subsequently calculates the power consumed. The novelty of this system is the implementation of the controlling mechanism of appliances in different ways. The developed system is a low-cost and flexible in operation and thus can save electricity expense of the consumers. We aim to determine the areas of daily peak hours of electricity usage levels and come with a solution by which we can lower the consumption and enhance better utilization of already limited resources during peak hours.*

Keywords:Internet of Things, Arduino, current sensors, ESP8266 Module(WSN), Power Management.

I. INTRODUCTION

With the advent of new technology, people want more comfort in their lives. In this new era of automated things such as automatic cars, automatic dish washers, automatic bots and so on, comes the need of automated homes where people have the luxury of doing things with least amount of effort. Also, this system is also built to help the disabled people with walking disabilities or old people who do not have energy to walk and switch off/on the home appliances. The basic motivation for building this product is to make the lives of people more comfortable and easy. It will give them a sense of security and also the comfort of stay at place and controlling systems through commands.

Wireless Sensor Networks (WSN) has been employed to collect data about physical phenomenon in various applications such as habitat monitoring. In wireless sensor network system, the sensor node sense the data from the sensor and that data collects the end tags, end

tags send its data to the router and router to coordinator and supply multi-clients services including data display, the whole data will be stored in base station and the stored data will send to the cloud and the client can visit the base station remotely via website. Such a sensor are temperature, vibration, pressure, moisture, light, and pollution.

The project aims at building a system which can be used on universally at any scale to monitor the parameters in each environment. Arduino and sensors collects all the real-time data from environment and this real-time data is fetched by the web server and display it. User can access this data from anywhere through Internet. Arduino works as a base station which connects the number of distributed sensor nodes.

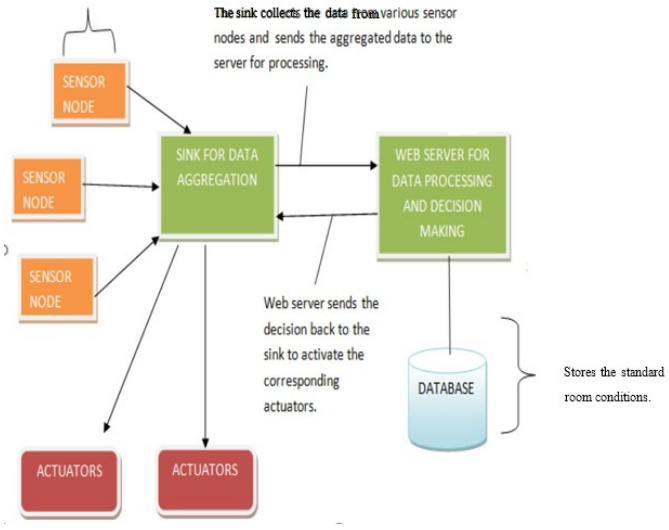


Fig1: Wireless Sensor Network System Framework

II PROPOSED SYSTEM DISCRIPTION

In this paper, we suggest a highly intractable and environmentally sustainable form of Home Automation System using Internet of Things a means to control the appliances at home via a device with access to the Internet. The proposed HAS can control the Lights, Fans, Air Conditioners (on/off/adjust), Doors and Door locks, Windows and Other/all appliances

Power management

Wireless sensor networks (WSNs) have become increasingly important because of their ability to monitor and manage situational information for various intelligent services. Due to those advantages, WSNs has been applied in many fields, such as the military, industry, environmental monitoring, and healthcare. The WSNs are increasingly being used in the home for energy controlling services. Regular household appliances are monitored and controlled by WSNs installed in the home.

Home automation

Home automation system is use of information technologies and control system to reduce the human labor. The rapid growth of technologies influences us to use smartphones to remotely control the home appliances. An automated device has ability to work with versatility,

diligence and with lowest error rate. The idea of home automation system is a significant issue for researchers and home appliances companies. Automation system not only helps to decrease the human labor but it also saves time and energy. Early home automation systems were used in labor saving machines but nowadays its main objective is providing facilities to elderly and handicapped people to perform their daily routine tasks and control the home appliances remotely.

Security

The doors and windows of the home are fitted with Magnetic Reed sensors coupled with PIR motion detectors. Whenever an unauthorized entry is detected, the shutters are closed and the user along with local police station are notified.

Automatic Gas Removal

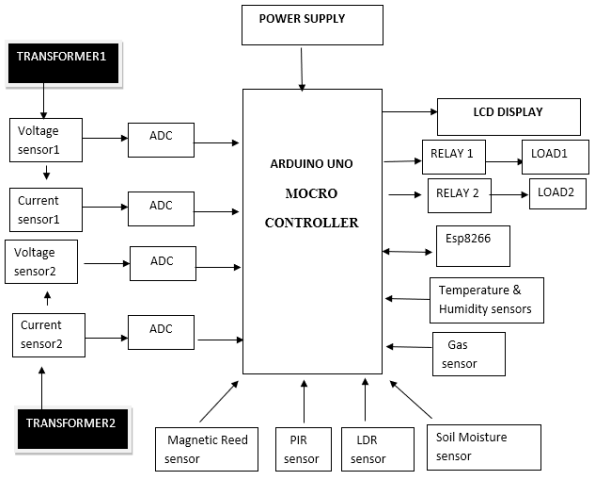
When a gas leakage is detected, all the electronic appliances are turned off, the user is notified about the leakage and a small exhaust fan is switched on to let the gas outside the house. After some time, the windows are opened and left as such until the user arrives and turns off the leak. In case of fire, MQ5 coupled with Flame sensor will detect it and the nearby fire station is notified.

Garden Maintenance

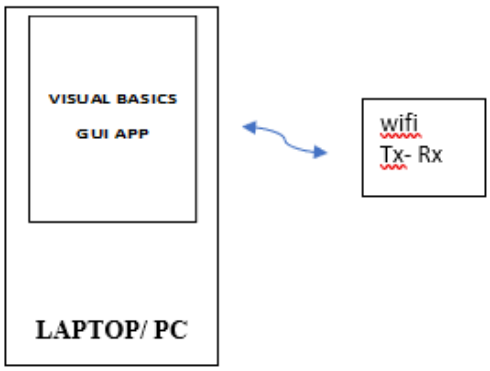
This perk requires the soil moisture sensor and the LDR to detect the levels of water in the soil and initiate a self-watering sequence until the garden has enough water. The LDR is used to detect the amount of sun rays being absorbed by the plants. If there is not adequate light, the reflector panels are engaged so that the plants receive the required amount of sunlight.

II. BLOCK DIAGRAM OF PROPOSED SYSTEM

a) BUILDING UNIT



b) Moniotoring and Control Unit



IV. HARDWARE ARCHITECTURE

a) ARDUINO UNO:

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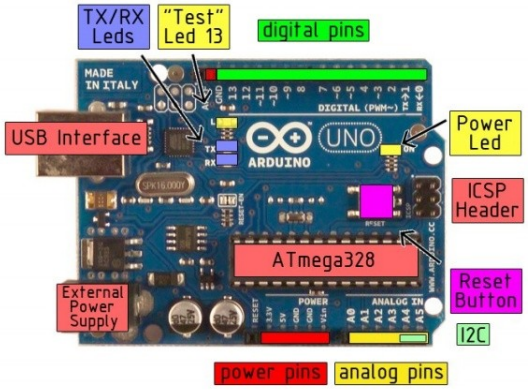
The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduno, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform;



Technical specifications of arduino:

Microcontroller: ATmega328

Operating Voltage: 5V

Input Voltage (recommended): 7-12V

Input Voltage (limits): 6-20V

Digital I/O Pins 14 (of which 6 provide PWM output)

Analog Input Pins 6

DC Current per I/O Pin 40 mA

DC Current for 3.3V Pin 50 mA

Flash Memory

32 KB of which 0.5 KB used by bootloader

SRAM 2 KB

EEPROM 1 KB

Clock Speed 16 MHz

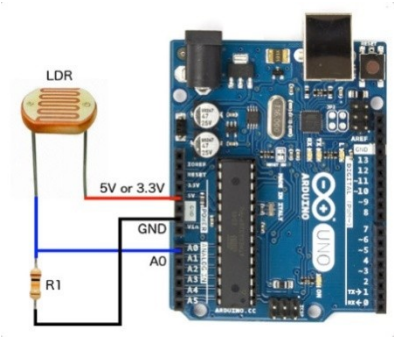
Sensors

This module consists of two sensors: Light Dependent Resistor (LDR) sensor and Digital Humidity and Temperature (DHT) sensor. LDR sensor checks the light intensity of the room. DHT sensor senses the environment and returns the value of current temperature and humidity.

b) **Light Dependent Resistor sensor:**

LDR consists of a high resistance semiconductor which reacts to only light intensity. In the dark, a LDR will show a high resistance which can be up to several mega ohms (MO). In bright light, a LDR have very less resistance which can be equal be few hundred Ohms. If light incidence on a photo resistor exceeds a certain frequency, photons

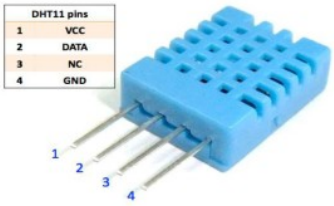
absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons conduct electricity, thereby lowering resistance. In this way, LDR sends less sensitive response to Arduino microcontroller.



LDR Sensor

c) Digital Humidity and TemperatureSensor:

The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is we can only get new data from it once every 2 seconds, so when using in library, sensor readings can be up to 2 seconds old.



DHT Sensor

MQ2 Sensor

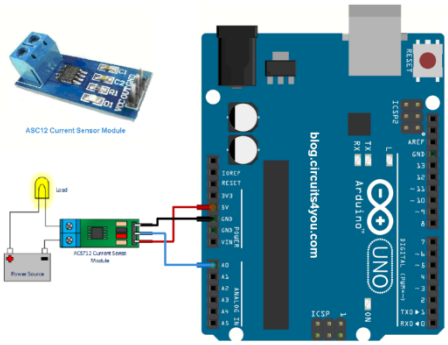
Sensitive material of MQ-2 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exists, the sensor's conductivity is higher along with the gas concentration rising. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application.

d) Current Sensor

The current sensor gives precise current measurement for both AC and DC signals. These are good sensors for metering and measuring overall power consumption of systems. The ACS712 current sensor measures

up to 5A of DC or AC current. We added an opamp gain stage for more sensitive current measurements. By adjusting the gain (from 4.27 to 47) you can measure very small currents.

The ACS712 Low Current Sensor Breakout outputs an analog voltage that varies linearly with sensed current. To calibrate, first set the output offset to the desired level (with zero current on the sense lines, read output with a DVM). Then with a known current input (a 100mA limited supply works well for this), set the output deflection with the gain pot. Sensitivity is then calculated as (Vref - Vdeflect)/(current input).



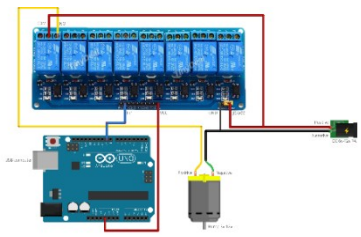
Actuators

Actuators play an important role in this system as they are the output formats which are activated whenever a user gives any command. We have used different LEDs for various devices such as fan, tube lights and air conditioners. LEDs have been used because they consume less power and Arduino being a low powered device, can withstand only minimal power for every component.

e) Relay and Relay Driver Circuit

Relay is nothing but it is the electromagnetic switch. Relay allows one circuit to switch another circuit while they are separated. Relay is used when we want to use a low voltage circuit to turn ON and OFF the device which required high voltage for its operation. For example, 5V supply connected to the relay is sufficient to drive the bulb operated on 230V AC mains. Relays are available in various configurations of operating voltages like 6V, 9V, 12V, 24V and so on. Relay is divided into two parts, one is input and other is output. Input side is nothing but a coil which generate magnetic field when small input voltage is given to it.

Relay having three contactors: Normally closed (NC), Normally opened (NO) and common (COM). By using the proper combinations of the contactors electrical appliances may turn ON or OFF.



f) Server & Ethernet shield

The Arduino ethernet shield allows an Arduino board to connect to the internet. It is based on the Wiznet W5100 ethernet chip. The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP. It supports up to four simultaneous socket connections. Arduino sends data to ethernet shield where it connects to server. The server (coded in PHP) then processes the data and sends command to Arduino via Ethernet shield.

V. SYSTEM IMPLEMENTATION

The proposed home automation system is an integrated system to facilitate elderly and disabled people with an easy to use that can be fully operated on voice commands. It is portable and constructed in a way that it is easy to install, configure, run and maintain. It works in two following modes:

A. **Automatic Mode**

In the installed system when the user wants to function automatically, first the voice command saying "auto" to be issued. Second, verification of components such as temperature and humidity alongside different elements performed for a remote observing framework using Wi-Fi. These hubs send information remotely to a central server, which gathers the information, caches it and permits it to be examined and showed as required. The knowledge base here is anlOT (Internet of Things) platform that tracks all the commands provided, also it can be used online base to receive remote sensor readings to store temperature and environment information. Based on these values, the system triggers the necessary actuators such as AC, Fan or tube light. Once the room conditions are favourable, the devices which are not required are switched off. This way energy is conserved. The cycle will repeat itself after a few minutes so that the user can get optimum comfort.

B. **Manual Mode**

If the user is not in need of automatic mode, he can switch to manual mode by issuing the voice command "manhome". This command will stop the sensors and now the control of the system lies in the hands of the user. A user has 4 options now. He can give the following commands to the system within 3 seconds of uttering the term "manhome".

1. "Fan"- This command will switch the current fan state.
2. "Light" - This command will switch the current light state
3. "AC"- This command will switch the current air conditioner state.
4. "All off' - This command will switch off all electrical devices.

If the user wants to again switch to automatic mode, he can again say the keyword "auto" and the system will switch to automatic mode.

With the above results, we can say that the system is working properly and there is hardly any chance of any error unless a system breakdown occurs. The system might be a tad slow because of so many devices connected to it but this problem can be solved by using a high-powered Arduino instead of the low powered one.

The current paper is novel in terms of other reported literature due to its control features. 1) Smart Power Metering System integrated with Traic: For switching on/off of the electrical appliances, we have used a triac-BT138. This enables the consumer for flexibility in controlling the devices: The users (inhabitants) have the options of switching the device on/off in three different ways

1) **Automatic control**: Based on the electricity tariff conditions, the appliance can be regulated with the help of smart software. This enables the user to have more cost saving by auto switch off the appliances during the electricity peak hours. The electricity tariff is procured from the website of the electricity supply company and is updated at regular intervals.
2) **Manual control:** An on/off switch is provided to directly intervene with the device. This feature enables the user to have more flexibility by having manual control on the appliance usage without following automatic control. Also, with the help of the software developed for monitoring and controlling user interface, user can control the device for its appropriate use. This feature has the higher priority to bypass the automatic control.
3) **Remote control:** The smart power monitoring and controlling software system has the feature of interacting with the appliances remotely through internet (website). This enables user to have flexible control mechanism remotely through a secured internet web connection. This sometimes is a huge help to the user who has the habit of keeping the appliances ON while away from house. The user can monitor the condition of all appliances and do the needful.

Thus, the user has the flexibility in controlling the electrical appliances through the developed prototype.

VI. ADVANTAGES and APPLICATIONS

a) ADVANTAGES

1. Network setups can be carried out without fixed infrastructure.

2. Suitable for the non-reachable places such as over the sea, mountains, rural areas or deep forests.
3. Flexible if there is random situation when additional workstation is needed.
4. Implementation pricing is cheap.
5. It avoids plenty of wiring.
6. It might accommodate new devices at any time.
7. It's flexible to undergo physical partitions.
8. It can be accessed by using a centralized monitor.

b) APPLICATIONS

- The applications for WSNs involve tracking, monitoring and controlling.
- WSNs are mainly utilized for habitat monitoring, object tracking, nuclear reactor control, fire detection, and traffic monitoring.
- Area monitoring is a very common application of WSNs, in which the WSN is deployed over a region where some incident might be monitored.

VII. SOFTWARE CODE IMPLEMENTATION

```
#include <LiquidCrystal.h>
LiquidCrystallcd(2, 3, 4, 5, 6, 7);
#include <SoftwareSerial.h>
#include <stdlib.h>
long milisec = millis();
long time=milisec/1000;
inti = 0;
double c1 = 0, p1, e1;
double c2 = 0, p2, e2;
char ch;
int count=0,temp;
char sm1=0;
char sm2=0;
String apiKey = "0Z4IAXY5N272DDXD";
SoftwareSerialser(10, 11); // RX, TX
int relay1=A2;
int relay2=A3;
intbuz=13;
intsensorIn;
intmVperAmp = 66; // use 100 for 20A Module and 66 for 30A Module
double Voltage = 0;
double VRMS = 0;
double AmpsRMS = 0;
intbuttonState = 1;
int buttonState1 = 1;

void setup(){
lcd.begin(16, 2);  // Print a msgto the LCD.
ser.begin(115200);
Serial.begin(9600);
lcd.setCursor(0, 0);
digitalWrite(8,HIGH);
pinMode(relay1,OUTPUT);
pinMode(relay2,OUTPUT);
pinMode(buz,OUTPUT);
```

```
digitalWrite(relay1,LOW);
digitalWrite(relay2,LOW);
digitalWrite(buz,HIGH);
ser.println("AT+RST");
delay(4000);
ser.println("AT+CWJAP=");
ser.write("");
ser.println("JioFi2_A467A7");
ser.write("");
ser.write(',');
ser.write("");
ser.println("5f8xcffzfk");
ser.write("");
ser.println();
}
void loop(){
long milisec = millis(); // calculate time in ms
long time=milisec/1000;
sensorIn=A0;
Voltage = getVPP();
VRMS = (Voltage/2.0) *0.707;
c1 = (VRMS * 1000)/mVperAmp;

 Voltage = getVPP();
 VRMS = (Voltage/2.0) *0.707;
 c1 = (VRMS * 1000)/mVperAmp;
if(c1<0.31)
c1=0;
else
c1=c1-0.31;
p1=c1*230;
e1=(p1 * time)/3600;
lcd.setCursor(0, 0);
lcd.print("C:");
lcd.setCursor(2, 0);
lcd.print(c1);
lcd.setCursor(7, 0);
lcd.print("e:");
lcd.setCursor(8, 0);
lcd.print(e1);
sensorIn=A1;
Voltage = getVPP();
VRMS = (Voltage/2.0) *0.707;
c2 = (VRMS * 1000)/mVperAmp;

Voltage = getVPP();
 VRMS = (Voltage/2.0) *0.707;
 c2 = (VRMS * 1000)/mVperAmp;
if(c2<0.31)
c2=0;
else
c2=c2-0.31;
p2=c2*230;
e2=(p2 * time)/3600;
lcd.setCursor(0, 1);
lcd.print("C:");
lcd.setCursor(2, 1);
lcd.print(c2);
lcd.setCursor(7, 1);
lcd.print("e:");
```

```
lcd.setCursor(8, 1);
lcd.print(e2);
temp=analogRead(A5)/3;
if(c1>=0.6)
send_sms(1);
if(c2>=0.6)
send_sms(2);
 String cmd = "AT+CIPSTART=\"TCP\",\"";
cmd += "184.106.153.149"; // api.thingspeak.com
cmd += "\",80";
ser.println(cmd);
delay(1500);
 String getStr ="GET /update?api_key=";
getStr += apiKey;
getStr +="&field1=";
getStr += String(c1);
getStr +="&field2=";
getStr += String(c2);
getStr +="&field3=";
getStr += String(temp);
getStr += "\r\n\r\n";

// send data length
cmd = "AT+CIPSEND=";
cmd += String(getStr.length());
ser.println(cmd);
delay(1500);
delay(6000);
cmd = "AT+CIPSTART=\"TCP\",\"";
cmd += "184.106.153.149"; // api.thingspeak.com
cmd += "\",80";
ser.println(cmd);
delay(1500);

getStr ="GET /talkbacks/13725/commands/4480820?api_key=2MNFP0XDPOVJW8NM\r\n\r\n";
  // send data length
cmd = "AT+CIPSEND=";
cmd += String(getStr.length());
ser.println(cmd);
delay(1500);
  //if(Serial.find(">")){
ser.print(getStr);
ch=0;
while(ch !=':')
ch=ser.read();
ch=ser.read();
 // Serial.println(char(ch));
if(ch=='1')
{
lcd.setCursor(15, 0);
lcd.print("1");
digitalWrite(relay1,HIGH);
}

if(ch=='2')
{
```

```
lcd.setCursor(15, 0);
lcd.print("2");
digitalWrite(relay1,LOW);
}
delay(6000);
cmd = "AT+CIPSTART=\"TCP\",\"";
cmd += "184.106.153.149"; // api.thingspeak.com
cmd += "\",80";
ser.println(cmd);
delay(1500);
getStr="GET /talkbacks/13725/commands/4480821?api_key=2MNFP0XDPOVJW8NM\r\n\r\n";

 // send data length
cmd = "AT+CIPSEND=";
cmd += String(getStr.length());
ser.println(cmd);
delay(1500);
 //if(Serial.find(">")){
ser.print(getStr);
ch=0;
while(ch !=':')
ch=ser.read();
ch=ser.read();
if(ch=='3')
{
lcd.setCursor(15, 1);
lcd.print("3");
digitalWrite(relay2,HIGH);
}
if(ch=='4')
{
lcd.setCursor(15, 1);
lcd.print("4");
digitalWrite(relay2,LOW);
}
delay(10000);
}
float getVPP()
{
 float result;
intreadValue;  //value read from the sensor
intmaxValue = 0;    // store max value here
intminValue = 1024;   // store min value here
 uint32_t start_time = millis();
 while((millis()-start_time) < 1000)
  {//sample for 1 Sec
readValue = analogRead(sensorIn);
        if (readValue>maxValue)
{  /*record the maximum sensor value*/
maxValue = readValue;
      }
      if (readValue<minValue)
{  /*record the maximum sensor value*/
minValue = readValue;
      }
}   // Subtract min from max
```

```
  result = ((maxValue - minValue) * 5.0)/1024.0;
      return result;
 }
 void send_sms(unsigned int v)
 {
digitalWrite(buz,LOW);
Serial.println("AT+CMGF=1");
delay(500);
Serial.print("AT+CMGS=");
Serial.write("");
Serial.print("8437163731");
Serial.write("");
Serial.println();
delay(500);
  if(v==1)
Serial.print("ALERT:UPS-1234  CONSUMING MORE POWER..");
   if(v==2)
Serial.print("ALERT:UPS-1234 RUNNING ON OVERLOAD...");
delay(500);
Serial.write(0x1a);
delay(500);
Serial.println();
digitalWrite(buz,HIGH);
 }
```

VIII.CONCLUSIONAND FUTUREENHANCEMENT

In this research work a low cost and user-friendly design for home automation system is presented. It has better performance than existing Bluetooth based conventional home automation systems, it provides a general approach for home automation which is not only suitable for elderly and handicapped people but it is also beneficial to reduce human labor and save energy with the help of sensors. In addition, proposed system has ability to transmit the measurement report of sensors on user smartphone application. Moreover, smartphone application used in proposed system has ability to interface up to 18 home appliances and sensors. Moreover, home automation system can be interfaced with biomedical (EMG) signals. It will be beneficial for amputees, they will be able to control the appliances using their muscle's movement.

Future work on this model includes expanding the mobile platform to IOS (IPhone operating system). Integrating a speech-to-text module to understand the user and speaker to interact with the user verbally. This also allows us to install a voice recognition system as an added security feature. A low-cost camera can be added for facial recognition which drastically improves the security of the system. Machine learning algorithms can be implemented to learn about

user patterns and suggest improvements in the current lifestyle such as track sleep patterns, quotidian tasks, and activity cycles. Modules such as heart beat sensor can be installed to check the health of the user.

IX. REFERENCES

[1] D. S.Ghataoura,J. E.Mitchell,andG. E.Matich,"Networkingandapplication interface technology for wireless sensor network surveillance and monitoring," IEEE Commun. Mag., vol. 49, no. 10, pp. 90–97, Oct. 2011.

[2] P. Cheong, K.-F. Chang, Y.-H. Lai, S.-K. Ho, I.-K. Sou, and K.-W. Tam, "A zigbee-based wireless sensor network node for ultraviolet detection of flame," IEEE Trans. Ind. Electron., vol. 58, no. 11, pp. 5271–5277, Nov. 2011.

[3] J. Misic and V. B. Misic, "Bridge performance in a multitier wireless network for healthcare monitoring," IEEE Wireless Commun., vol. 17, no. 1, pp. 90–95, Feb. 2010.

[4] M. Erol-Kantarci and H. T. Mouftah, "Wireless sensor networks for costefficient residential energy management in the smart grid," IEEE Trans. Smart Grid, vol. 2, no. 2, pp. 314–325, Jun. 2011. [6] ZigBee alliance examining Japan's new smart home recommendations.

[5] K. Mandula, R. Parupalli, C. A. S. Murty, E. Magesh and R. Lunagariya, "Mobile based home automation using Internet of Things(loT)," 2015 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICcrCCT), Kumaracoil, 2015, pp. 340-343. [2]

[6] D. Chowdhry, R. Paranjape and P. Laforge, "Smart home automation system for intrusion detection," 2015 IEEE 14th Canadian Workshop on information Theory (CWIT), St. John's, NL, 2015, pp. 75-78.

About Author

P.ASHOK KUMAR
Research Scholar
Department of ECE
Sri Satya Sai University of Technology and Medical Sciences Bhopal MP (India)
pashok9@gmail.com