Smart Home Using IOT Integrated with Cloud

Contents

Abstract

Now-a-days moving with Automation technology(AT),life is getting easier and comfort in all aspects. Globally Automatic systems are more preferable than manual systems. Day by day the number of internet users are rapidly increase over the past decade has made it a part of life and IOT is the latest emerging internet technology. The Internet of Things (IOT) refers to the use of intelligently connected devices and systems to leverage data gathered by embedded sensors and actuators in machines and other physical object. Wireless Smart Home system(WSHS) with IOT that uses computers and smart mobiles to control the home appliances automatically through internet anytime from anywhere in the world, a Smart Home is also called as Home Automation. It is meant, to save the power and human energy.

Introduction

1.1 Home Automation

Automation is the process of automatically performing everyday functions around the home to save you time, energy, money and at the same time offering improved security.

The automation' is performed by a central controller. This can be either a standalone unit or a piece of software on a PC. Both options have their advantages. The controller can carry out a number of functions:

1.2 Functions

Send signals to switch lights and appliances on or off. Open and close contacts to operate high and low voltage devices. Schedule and initiate events, such as watering the garden Issue and accept infra red commands Interface with other systems, i.e. X 10, telephone, computer, heating etc.

Home automation is anything that gives you remote or automatic control of things in & around the home. The systems that you can control include: Lighting, Appliances, Heating and cooling, Security and monitoring systems, Entertainment (home audio and video), Communications (telephones and intercoms, internet), Lawn sprinklers, Curtain movements, Pool filter pump, Spa heater, Filtration unit, Gate/garage door motor, Shade motor control, Roof sprinklers, Electric strikes, Keyless entry etc.

This central controller can be accessed and controlled through interfaces like keypad, wired or wireless touch-screens (with/without video), universal remotes, mobile devices. Home automation provides a more convenient & elegant atmosphere for the family to compliment and match the lifestyle. Every one in the family experiences the comfort of automation with added convenience through integrated control of scheduled common lifestyle activities performed everyday. An automated home can provide security, temperature, lighting, and audio control for comfort, convenience, and safety. It creates reliable and coordinated controls to operate home devices automatically for simplifying operations.

Home automation saves your time and effort by controlling you home automatically for performing routine functions such as watering your grass, or turning off all lights, setting the thermostat to economy mode, control scheduled appliances operation and arming the security system when you retire for the night

Home automation provides you with the comfort of whole home audio/video integration so that any source could be placed anywhere in a home and still be enjoyed everywhere in a home.

Home automation provides you pro-active home security so that you can look in on your home remotely from anywhere in the world, or that your home will phone you if it finds anything suspicious, or that a fire will alert your home to wake you, shut down the gas and ventilation system, turn on a lighting path for your escape, and automatically phone the fire/police department. In other words it integrates your alarm system with other home systems for a response to intrusion that meets your needs of enhanced Safety.

The term 'home automation' is now acknowledged as covering most I.T., automation, communication and wiring aspects of our homes. Most of these functions can be installed independently of each other, but the real benefits of the automated home are realized when these different aspects communicate with each other. For example, having two PC's networked together in the home, giving both users access to the internet may seem like the forefront of technology, but imagine if they were tied into our house wiring and could turn lights and appliances on and off automatically when we are away from home, even via the internet. Imagine that the PC was networked into our security system and could display images from our home security cameras onto our computer screen at work. Imagine that your security system was tied into your telephone and could ring your mobile in the event of a burglary, you could even talk to visitors to your door from anywhere in the world.

1.3 Objectives of Home Automation

Home Automation Saves Money by lowering your monthly utility bills with the remote & scheduled control of lights, appliances, sprinklers and your air conditioning

1. Never walk into a dark home again.
2. Have the porch light automatically turn on when you open the front door after dark. Lighting and audio controls can make a vacant home look and sound occupied.
3. You could set your Omni home control system to automatically call you at work when your child comes home from school and keys in his security code into the security system.
4. Call your home control system over the phone to make changes to your system.
5. Log into your home control system over the Internet via Snap-Link or Web-Link II and change your temperature settings.
6. Set the temperature setting on your Omnistate to automatically turn up when the security system is armed in the morning. It is then automatically turned down one-half hour before you normally get home in order for you to arrive home to a comfortable house.
7. If you are leaving early from work, you can call into your home control system to manually set the temperature to where you want it to be when you get home.

1.4 The Real Benefits of Home Automation

Most controllers will offer all of the above plus more. When you use controllers connected in the appropriate fashion, you can realize all sorts of benefits, limited primarily by your imagination.

For example:-

When on holiday or working late, have the lights come on automatically and draw the curtains.
Set room moods, i.e. one button push to switch off the main light, dim the perimeter lights and switch the surround sound system on ready to play a movie.
At dusk, check that the garage door is closed.
Switch on the electric blanket whilst you're sitting on your sofa.

The controller can be either standalone or combined into a security system to give additional benefits.

Security

There are real benefits to having your automation controller and security system combined in one unit. You have the advantage of infra red detectors from the alarm system being available to perform/trigger automation tasks. You can also benefit from the alarm system knowing whether you’re at home or not (i.e. whether the alarm is set or not). This can give numerous benefits, for example we could set the system so that if no movement is detected in the home for a given period, say 16 hours, then it rings a mobile telephone and conveys a message to the recipient. This can be particularly relevant when you have concerns about ailing relatives having accidents around the home etc.

Needless to say, if the alarm system forms the basis of our automation system, then it needs to be of a particularly high standard, able to expand to suit all requirements. You should be able to connect smoke detectors in to the system and when triggered, automatically switch on lights to illuminate the exit route whilst at the same time dialing the fire brigade with a pre recorded message. For further information, see details of our Comfort System.

2. Project Description

2.1 Basic Idea

Basic idea of Smart Home automation using Cloud services is Controlling the home appliances remotely over the internet.

Homes of the 21st century will become more and more self-controlled and automated due to the comfort it provides, especially when employed in a private home. A home automation system is a means that allow users to control electric appliances of varying kind.

Many existing, well-established home automation systems are based on wired communication. This does not pose a problem until the system is planned well in advance and installed during the physical construction of the building. But

for already existing buildings the implementation cost goes very high. In contrast, Wireless systems can be of great help for automation systems. With the advancement of wireless technologies such as Wi-Fi, cloud networks in the recent past, wireless systems are used every day and everywhere.

we will present a Smart Home system(SHS) using ARDUINO UNO ATMEGA328 that employs the integration of cloud networking, wireless communication, energy monitoring, or weather stations, capturing the photo of a person moving around the house and storing it onto the cloud.SHS is to provide the user with remote control of various lights, fans, and appliances within their home and storing the data in the cloud. The system will automatically change on the basis of sensors' data. This system is designed to be low cost and expandable allowing a variety of devices to be controlled

2.2 Cloud:

Home automation systems face four main challenges, these are high cost of ownership, inflexibility, poor manageability, and difficulty in achieving security. The main objectives of this research is to design and implement a home automation system using IoT that is capable of controlling and automating most of the house appliances through an easy manageable web interface. The proposed system has a great flexibility by using Wi-Fi technology to interconnect its distributed sensors to home automation server. This will decrease the deployment cost and will increase the ability of upgrading, and system reconfiguration.

2.3 Proposed Block diagram:

The proposed system is a distributed home automation system, consists of server, sensors. Server controls and monitors the various sensors, and can be easily configured

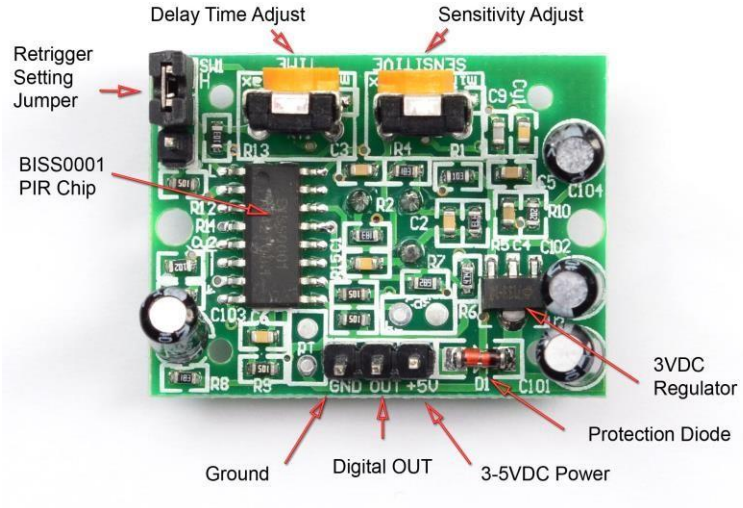
to handle more hardware interface module (sensors). The Intel Galileo development board, with built in WiFi card port to which the card is inserted, acts as web server. Automation System can be accessed from the web browser of any local PC in the same LAN using server IP, or remotely from any PC or mobile handheld device connected to the internet with appropriate web browser through server real IP (internet IP). WiFi technology is selected to be the network infrastructure that connects server and the sensors. WiFi is chosen to improve system security (by using secure WiFi connection), and to increase system mobility and scalability.

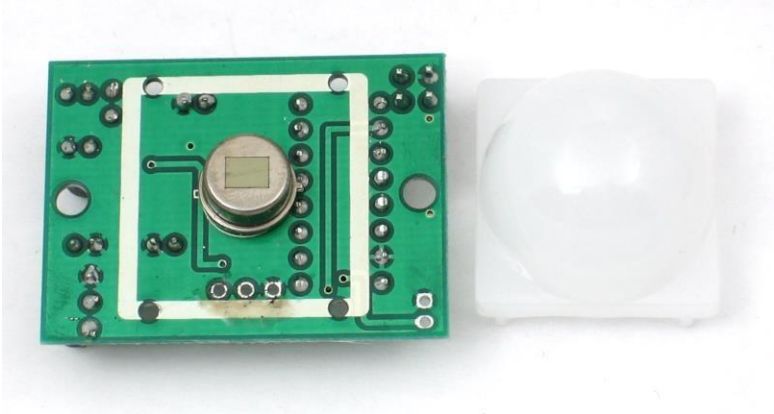
3. Hardware and circuit Diagram:

3.1 Hardware:

a). PIR Sensor to ardiuno:

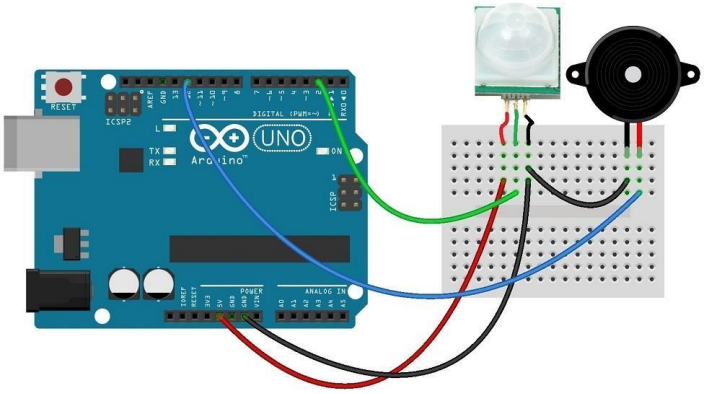
PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.





PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

Circuit diagram:



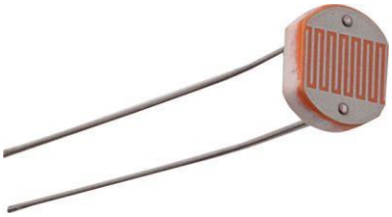
Project Code:

```
/*
* PIR sensor tester
*/
int ledPin =13;// choose the pin for the LED
int inputPin =2;// choose the input pin (for PIR sensor)
int pirState = LOW;// we start, assuming no motion detected
int val =0;// variable for reading the pin status
void setup(){
pinMode(ledPin, OUTPUT);// declare LED as output
pinMode(inputPin, INPUT);// declare sensor as input
Serial.begin(9600);
}
void loop(){
val = digitalRead(inputPin);// read input value
```

```
if(val == HIGH){// check if the input is HIGH
digitalWrite(ledPin, HIGH);// turn LED ON
if(pirState == LOW){
// we have just turned on
Serial.println("Motion detected!");
// We only want to print on the output change, not state
pirState = HIGH;
}
}else{
digitalWrite(ledPin, LOW);// turn LED OFF
if(pirState == HIGH){
// we have just turned of
Serial.println("Motion ended!");
// We only want to print on the output change, not state
pirState = LOW;
}
}
}
```

b) LDR Sensor :

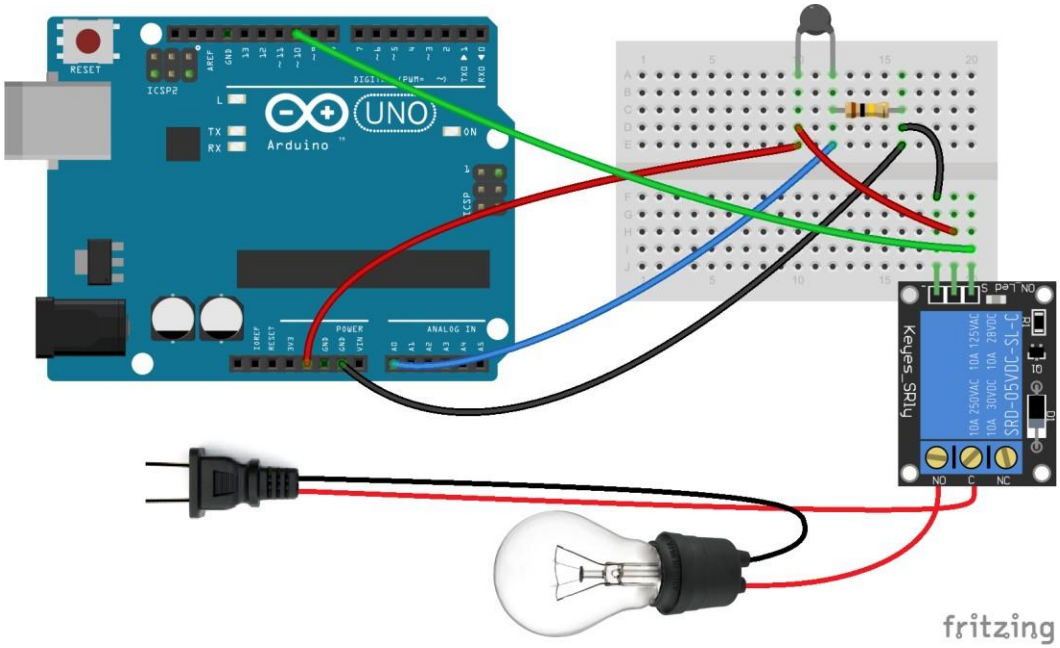
A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a LDR, one of the most commonly used symbol is shown in the figure below. The arrow indicates light falling on it.



Block diagram:

When LDR is connected to Arduino with relay along actuator when there is more intensity the light is switched off and when there is darkness light will switch on. The circuit diagram is as follows.

Circuit diagram:



Project Code:

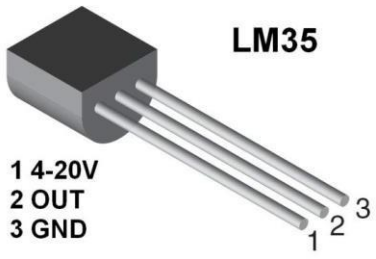
```
int sensorPin = A0; // select the input pin for ldr

int sensorValue = 0; // variable to store the value coming from the sensor
```

```
void setup() {

Serial.begin(9600); //sets serial port for communication

}

void loop() {

sensorValue = analogRead(sensorPin); // read the value from the sensor

Serial.println(sensorValue); //prints the values coming from the sensor on the screen

delay(100);

}
```

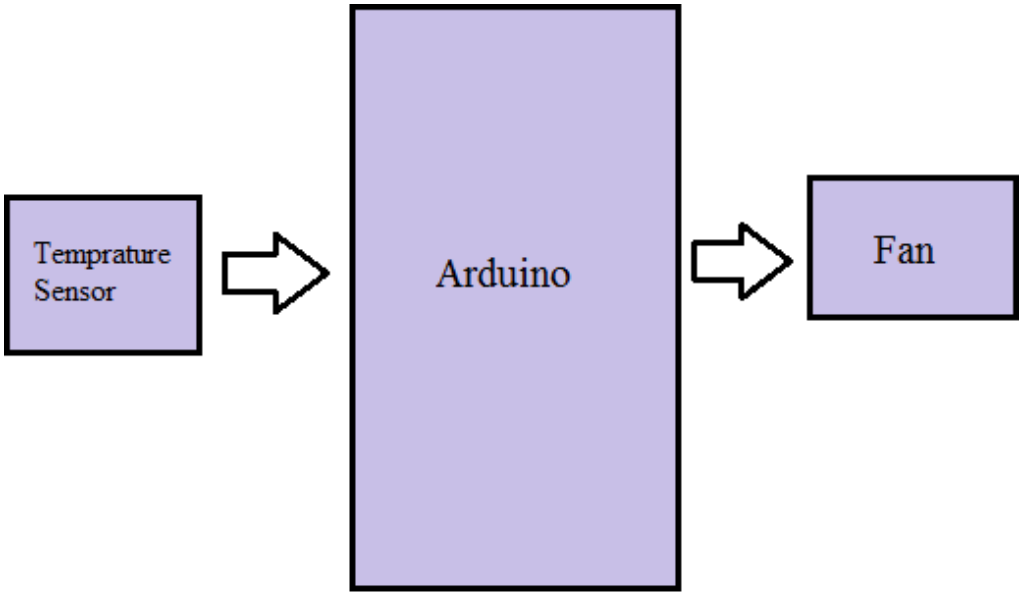
C) ARDUINO TEMPERATURE SENSOR LM35:

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearlyproportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear

output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 μA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy). The LM35-series devices are available packaged in hermetic TO transistor packages, while the LM35C, LM35CA, and LM35D devices are available in the plastic TO-92 transistor package. The LM35D device is available in an 8-lead surface-mount small-outline package and a plastic TO-220 package

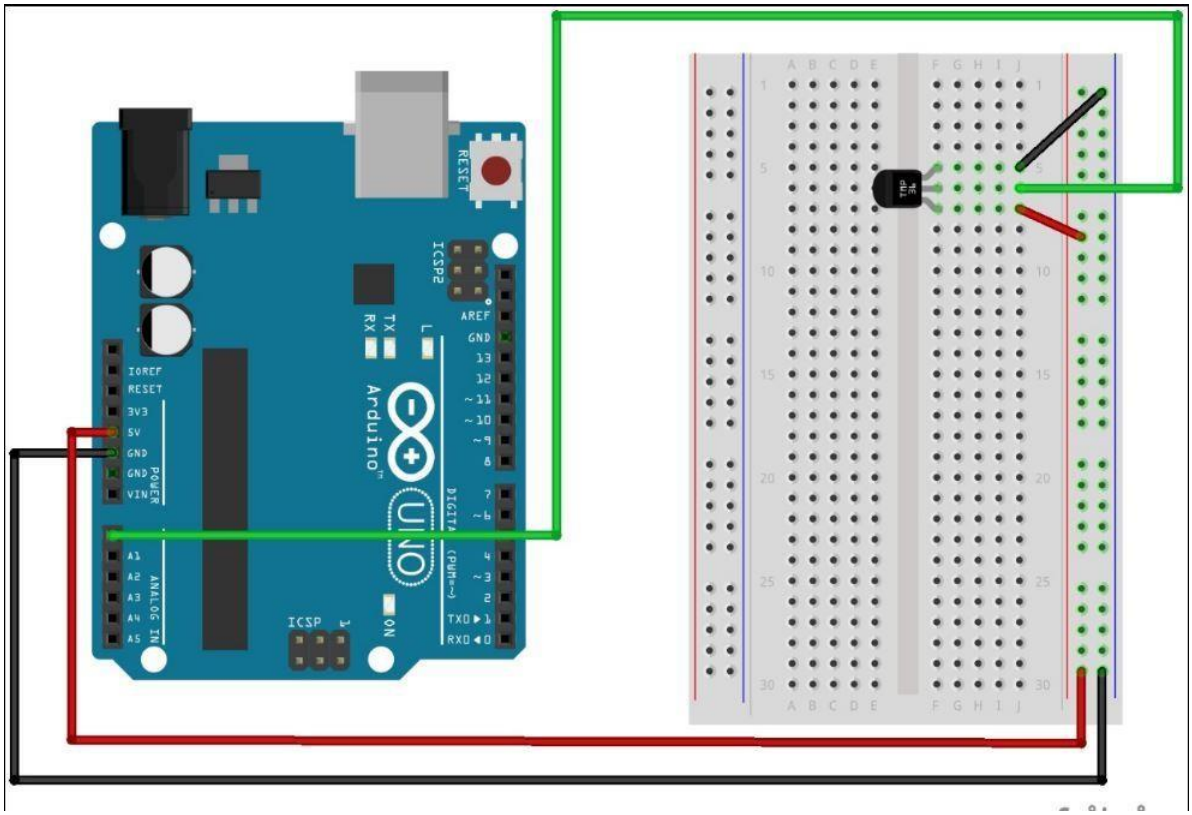


Block Diagram:



Block Diagram of Temprature control Fan

Circuit Diagram:



Project Code:

```
int a;

float b;

float c;

float f;

void setup() {

  // put your setup code here, to run once:

Serial.begin(9600);

}



void loop() {

  // put your main code here, to run repeatedly:

a=analogRead(A0);

b=(float)(a/1024.0)*5000;

c=0.1*b;

f=273+c;
```

```
Serial.println("The Temperature is the reading we get from sensor");

Serial.print("In kelvin");

Serial.println(f);

Serial.print("In celcuis");

Serial.print(c);

delay(3000);

}
```

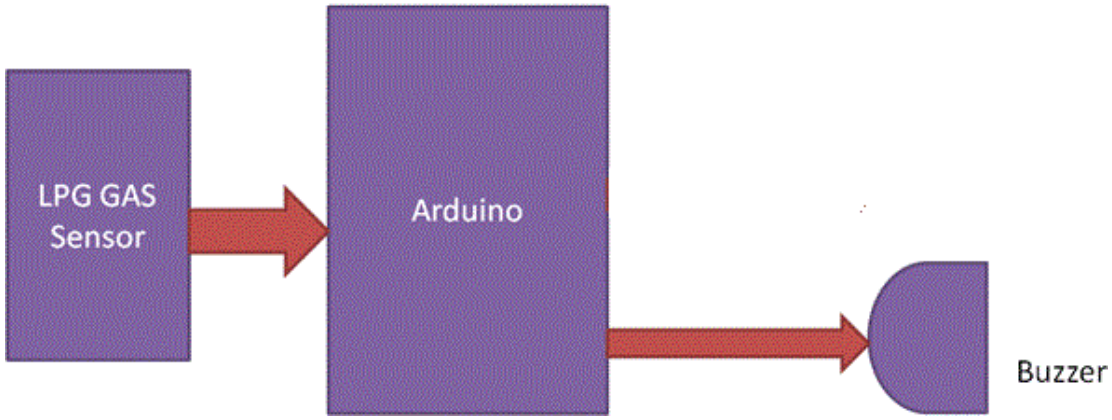
D) GAS Sensor MQ2:

The MQ series of gas sensors use a small heater inside with an electro-chemical sensor. They are sensitive for a range of gasses and are used indoors at room temperature. The output is an analog signal and can be read with an analog input of the Arduino.

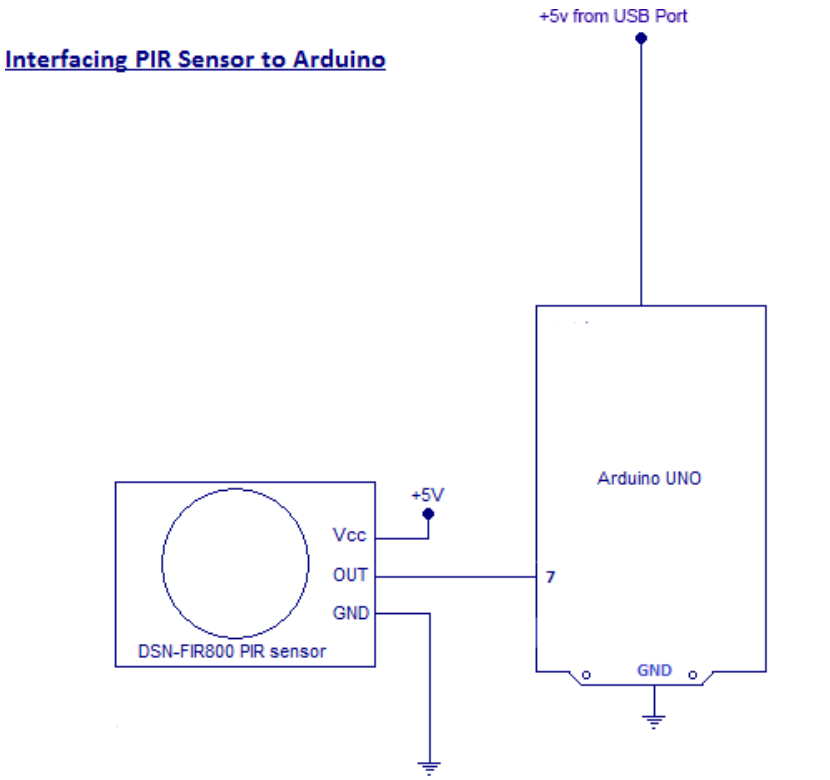
The MQ-2 Gas Sensor module is useful for gas leakage detecting in home and industry. It can detect LPG, i-butane, propane, methane ,alcohol, hydrogen and smoke.

Some modules have a built-in variable resistor to adjust the sensitivity of the sensor.

Block Diagram:



Circuit Diagram:



Project Code:

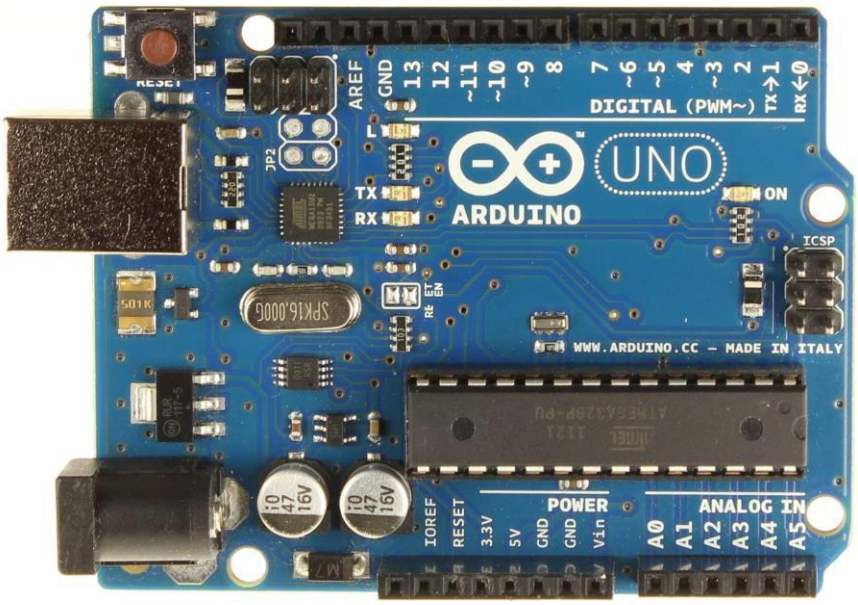
```
int sensor=7;

int gas_value;

void setup() {

  pinMode(sensor,INPUT);

  Serial.begin(9600);
```

```
}
```

```
void loop() {

  gas_value=digitalRead(sensor);

  Serial.println(gas_value);

}
```

4. Ardunio ATMega328:

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.



"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards

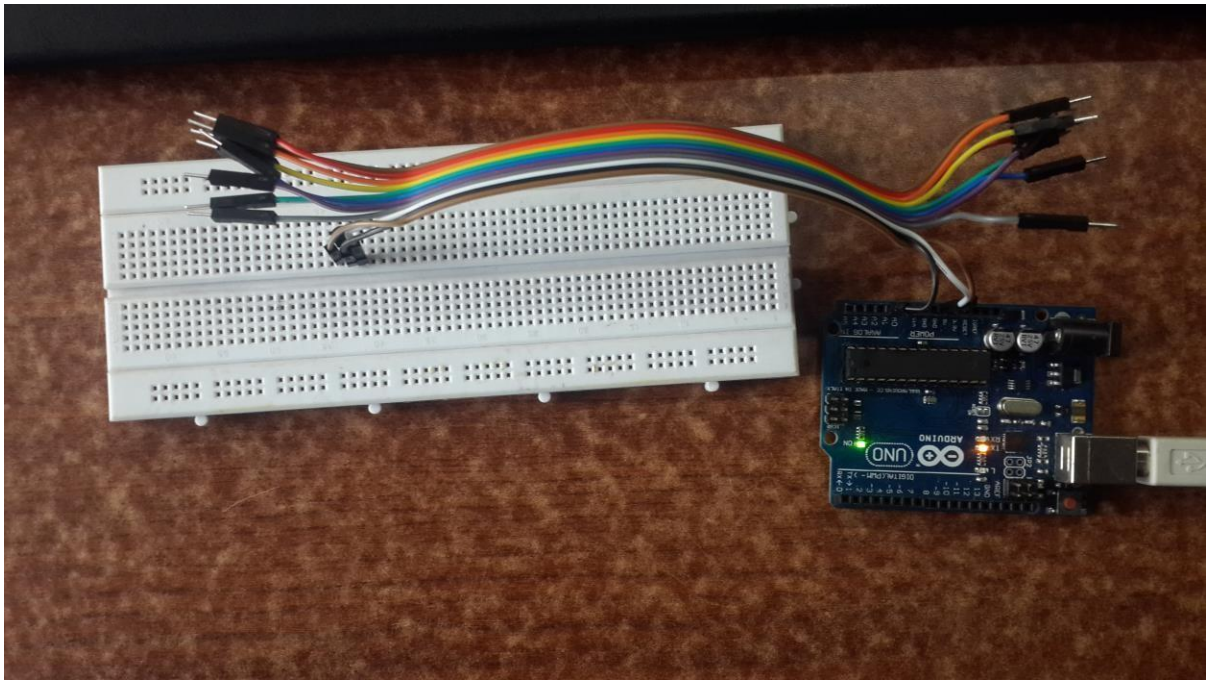
5. Implementation of project:

We did this project this first by separate modules with all the sensors thereafter we integrated all the sensors with actuators.

The Output of each module connected with ardunio is observed in the serial monitor.

Temperature Sensor to ardunio:

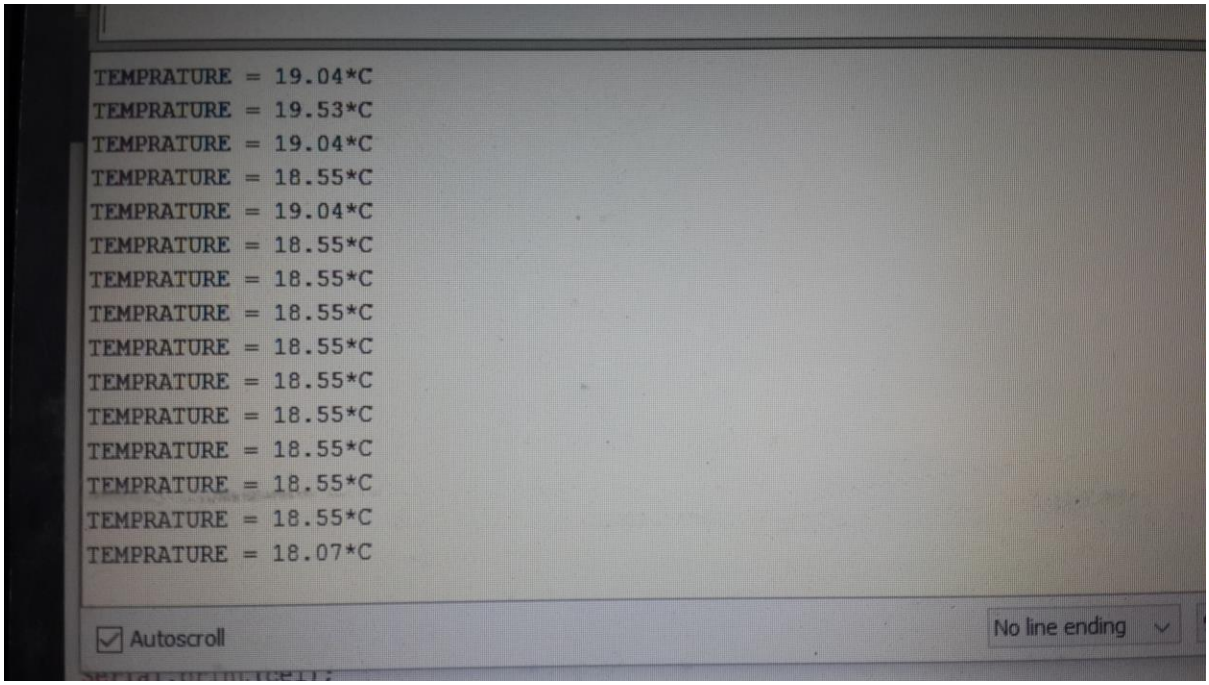
When Temperature sensor is connected to arduino the output in the serial monitor are increasing when the room temperature is high . If the room temperature is cool then the readings are observed that goes down from previous recordings.



```
TEMPRATURE = 20.51*C
TEMPRATURE = 20.02*C
TEMPRATURE = 20.02*C
TEMPRATURE = 20.02*C
TEMPRATURE = 20.51*C
TEMPRATURE = 19.53*C
TEMPRATURE = 20.02*C
TEMPRATURE = 19.04*C
TEMPRATURE = 19.53*C
TEMPRATURE = 19.04*C
TEMPRATURE = 19.53*C
TEMPRATURE = 19.53*C
TEMPRATURE = 19.53*C
TEMPRATURE = 19.04*C
TEMPRATURE = 19.04*C
```

Autoscroll

No line ending

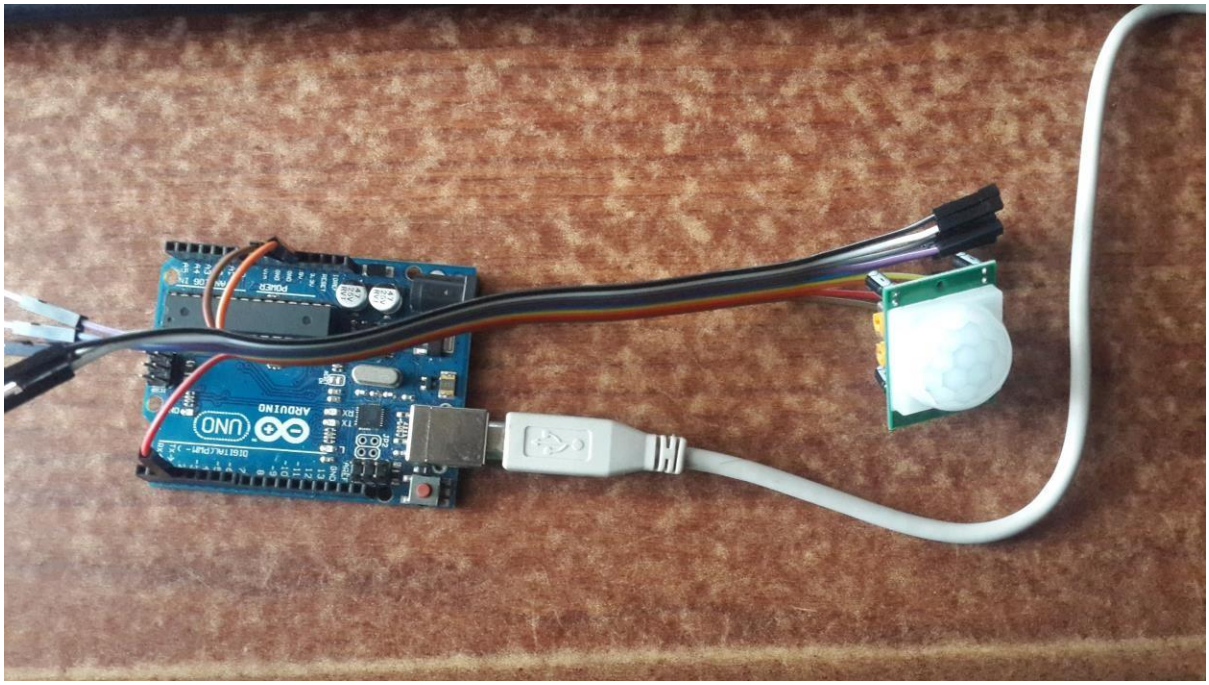


LDR sensor with Ardunio:

When we connected LDR with ardunio as per the circuit diagram we constructed .The values in the serial monitor are reaches to zero in the darkness or when reaches to low values when there is less bright. If the intensity is more than the values are increases rapidly based on intensity on the LDR.

PIR Sensor with ardunio:

PIR sensor is connected to ardunio and observed in the serial monitor that the readings are 0 when there is no object is moving in front of it. It is 1 if any object is moving in front of the sensor.



Gas Sensor MQ2:

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The MQ-2 Gas Sensor module is useful for gas leakage detecting in home and industry. It can detect LPG, i-butane, propane, methane ,alcohol, hydrogen and smoke.

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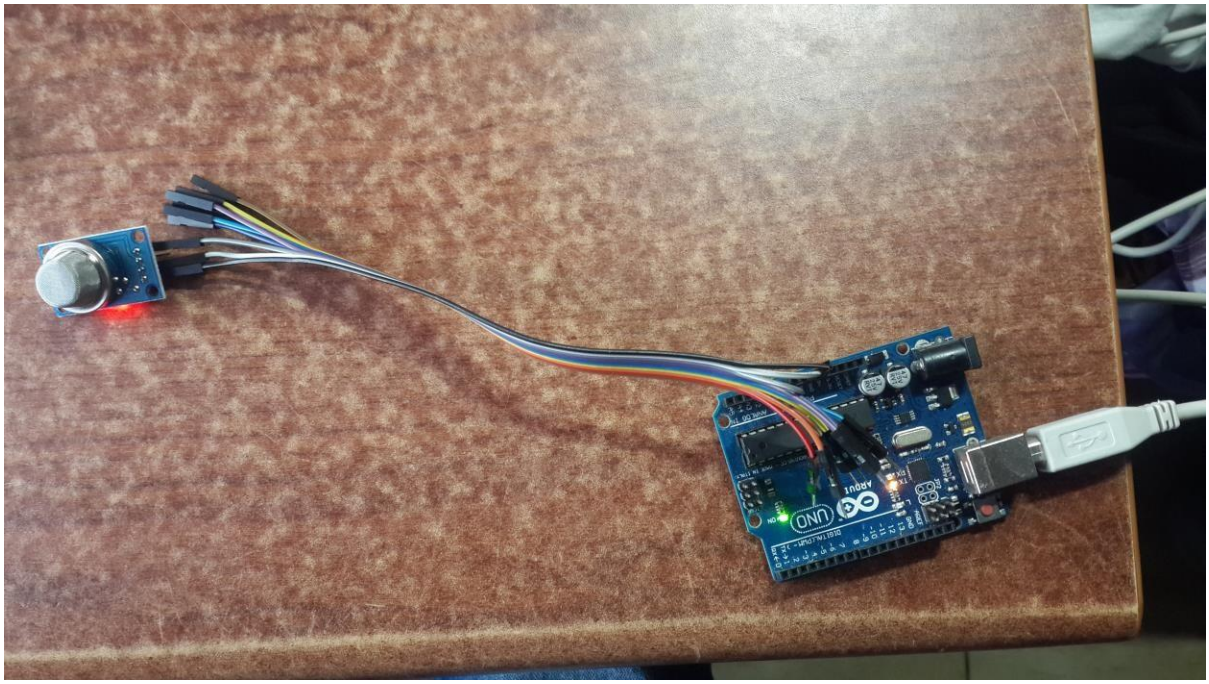
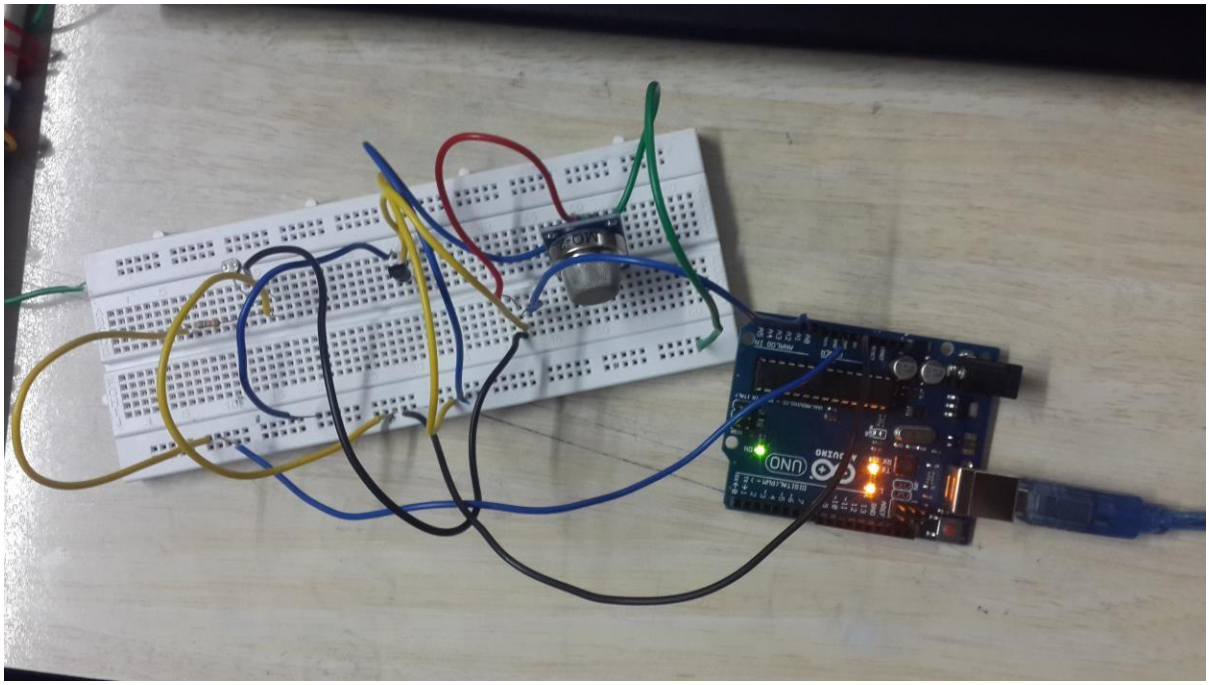


After the individual modules with ardunio we integrated all the components and observed the output in the serial monitor .



Along with sensors we added actuators to control home automation. For each electronic appliance we added relay because it is used to control a circuit by a separate low-power signal,

Project Code:

```
int val;
int tempPin = 1;                                                    // temperature Sensor
int sensor=7;
int gas_value;                                                      // GAS SENSOR
int sensorPin = A0; // select the input pin for ldr                 // LDR sensor
int sensorValue = 0; // variable to store the value coming from the sensor
//PIR Sensor
/*
* PIR sensor tester
*/
int ledPin =13;// choose the pin for the LED
int inputPin =2;// choose the input pin (for PIR sensor)
int pirState = LOW;// we start, assuming no motion detected
int valu =0;// variable for reading the pin status
void setup()
{
  pinMode(sensor,INPUT);
  pinMode(ledPin, OUTPUT);// declare LED as output
  pinMode(inputPin, INPUT);// declare sensor as input
  Serial.begin(9600);
}
void loop()
{
val = analogRead(tempPin);
float mv = ( val/1024.0)*5000;
float cel = mv/10;
float farh = (cel*9)/5 + 32;
Serial.print("TEMPRATURE = ");
Serial.print(cel);
Serial.print("*C");
Serial.println();
delay(1000);

/* uncomment this to get temperature in farenhite
Serial.print("TEMPRATURE = ");
Serial.print(farh);
Serial.print("*F");
Serial.println();


*/
   gas_value=digitalRead(sensor);
   valu = digitalRead(inputPin);// read input value
     if(valu == HIGH)
            {
                 // check if the input is HIGH
                    digitalWrite(ledPin, HIGH);// turn LED ON
```

```
        if(pirState == LOW)
             {
               // we have just turned on
                    Serial.println("Motion detected!");
               // We only want to print on the output change, not state
                    pirState = HIGH;
              }
          }
          else
           {
             digitalWrite(ledPin, LOW);// turn LED OFF
             if(pirState == HIGH)
               {
                 // we have just turned of
                      Serial.println("Motion ended!");
                 // We only want to print on the output change, not state
                       pirState = LOW;
               }
            }
  Serial.println(gas_value);
  sensorValue = analogRead(sensorPin); // read the value from the sensor
  Serial.println(sensorValue); //prints the values coming from the sensor on the screen
  delay(100);
}
```

7. Home Automation Applications:

7.1 Introduction

A major appliance, or domestic appliance, is usually defined as a large machine which accomplishes some routine housekeeping task, which includes purposes such as cooking, food preservation, or cleaning, whether in a household, institutional, commercial or industrial setting. An appliance is differentiated from a plumbing fixture because it uses an energy input for its operation other than water, generally using electricity or natural gas/propane. An object run by a watermill would also be considered an appliance. Major appliances are differentiated from small appliances because they are large, difficult to move, and generally fixed in place to some extent. They are often considered fixtures and part of real estate and as such they are often supplied to tenants as part of otherwise unfurnished rental properties. Another frequent characteristic of major appliances is that they may have substantial electricity requirements that necessitate special electrical wiring to supply higher current than standard electrical outlets can deliver. This limits where they can be placed in a home.

Home automation may designate an emerging practice of increased automation of household appliances and features in residential dwellings, particularly through electronic means that allow for things impracticable, overly expensive or simply not possible in recent past decades. The term may be used in contrast to the more mainstream "building automation," which refers to industrial settings and the automatic or semi-automatic control of lighting, climate doors and windows, and security and surveillance systems. The techniques employed in home automation include those in building automation as well as the control of home

entertainment systems, houseplant watering, pet feeding, "scenes" for different events (such as dinners or parties), and the use of domestic robots.

Home automation has been around since World War I. A television remote was first patented in 1950 and a remote control device was first used by the Germans in World War I to control motorboats. From there, the evolution of controllers and automation has been growing and still continue to grow to this day.

In advanced installations, rooms can sense not only the presence of a person but know who that person is and perhaps set appropriate lighting, temperature, music or television levels taking into account the day of the week, the time of day, and other factors.

Other automated tasks may include setting the air conditioning to an energy saving setting when the house is unoccupied, and restoring the normal setting when an occupant is about to return. More sophisticated systems can maintain an inventory of products, recording their usage through an RFID tag, and prepare a shopping list or even automatically order replacements.

7.2 Different Home Automation Appliances

1- Heating, Ventilation and Air Conditioning

Heating, Ventilation and Air Conditioning solutions include temperature and humidity control (climatic). This is generally one of the most important aspects to a homeowner. An Internet-controlled thermostat, for example, can both save money and help the environment, by allowing the homeowner to control the building's heating and air conditioning systems remotely.

2- Lighting

Lighting control systems involves aspects related to controlling electric lights.

- Extinguished general of all the lights of the house
- Automation of switched off / ignition in every point of light
- Regulation of the illumination according to the level of ambient luminosity

3- Natural lighting

Natural lighting control involves controlling window shades, LCD shades, draperies and awnings. Recent advances include use of RF technology to avoid wiring to switches and integration with third party home automation systems for centralized control.

4- Audio

Major companies associated with Audio Distribution include: There are three components that allow the consumer to listen to audio throughout your home, or business:

- Cat 5e/CAT 6 cable from Audio central unit.
- 2 sets of speaker cabling (4ply from amplifier, and 2 ply from key pad to ceiling or wall speakers).
- A keypad to control your volume and sources.

This category includes audio switching and distribution. Audio switching determines the selection of an audio source. Audio distribution allows an audio source to be heard in one or more rooms. This feature is often referred to as 'multi-zone' audio.

5- Video

This includes video switching and distribution, allowing a video source to be viewed on multiple TVs. This feature is often referred to as 'multi-zone' video.

Integration of the intercom to the telephone, or of the video door entry system to the television set, allowing the residents to view the door camera automatically.

6- Security

Control and integration of security systems.

With Home Automation, the consumer can select and watch cameras live from an Internet source to their home or business. Security cameras can be controlled, allowing the user to observe activity around a house or business right from a Monitor or touch panel. Security systems can include motion sensors that will detect any kind of unauthorized movement and notify the user through the security system or via cell phone.

This category also includes control and distribution of security cameras

- Detection of possible intrusion
  - sensors of detection of movement
  - sensors of magnetic contact of door/window
  - sensors of glass breaking
  - sensors of pressure changes
- Simulation of presence.
- Detection of fire, gas leaks, water leaks (see fire alarm and gas alarm)
- Medical alert. Teleassistance.
- Precise and safe closing of blinds.

7- Intercoms

An intercom system allows communication via a microphone and loud speaker between multiple rooms.

1. Ubiquity in the external control as much internal, remote control from the Internet, PC, wireless controls electrical equipment.
2. Transmission of alarms.
3. Intercommunications.

Using special hardware, almost any device can be monitored and controlled automatically or remotely.

8 - Plant Watering

8. Pool pump(s) and heater, Hot tub and Spa
9. Sump Pump (need info and links)

9. Conclusions:

This project is developed make a smart home automation system with sensors and actuators national and multinational organizations which keeps large amount of money in their office and want 100% security. Their main requirements were they wanted a system that could alert them when burglary takes place at the time when office is closed. These organizations are very big and have many employees; most of the employees do overtime and stay at office for late nights. Supervisor is responsible to switch off the electric lights, other appliances and lock the office after everyone leaves but the main problem was this supervisor had to stay with employees for long time until they finish their work, so we proposed this system to these organizations that can solve out their problems. Now supervisor can monitor the employees from their houses using live web cams, turn off lights and doors when everyone is gone.

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